uMKHANYAKUDE DISTRICT MUNICIPALITY

UPGRADE OF COMMAND RESERVOIR AND WATER RETICULATION - HLUHLUWE PHASE 2
CONTRACT NO. SCMU005/2025/2026

CIDB CONTRACTOR GRADING
8CE OR HIGHER

COMPILED BY:

Zimile
1 George Macfarlane Ln
Townhill, Pietermaritzburg
3201
Tel : 039 940 6729
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ON BEHALF OF:

uMkhanyakude District Municipality
Harlingen 13433
Kingfisher Road
Mkuze
3965
Tel: +27 35 573 8600
Fax : +27 35 573 8730

06 November 2025

NAME OF TENDERER	
ADDRESS OF TENDERER	
TELEPHONE	
FAX	
E-MAIL ADDRESS	
TENDER SUM	

TENDER CLOSING DATE: 12H00, 18 November 2025

SUMMARY FOR TENDER OPENING PURPOSES

[To facilitate the reading out of tender parameters at the opening of tenders, the tenderer shall complete this form and submit it with his tender. This form does not replace the Form of Offer, C1.1, which must be completed]

Name of Contractor submitting the tender: ....

Tender amount *(as stated in the Form of Offer)*

Time for Completion offered: .....

Details of contact person:

Name *(Print):* .....

Telephone No: ..... Fax No*:* .....

Cell Phone*:* ....

Email address: ....

Is Form of Offer signed by Tenderer and Witnesses? .....(*Yes / No*)

SIGNATURE*:* .....

(of person authorised to sign the tender)

Note: In the event of conflict between the data provided in this summary and that given in the Form of Offer, C1.1, the Form of Offer shall prevail.

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T1: TENDERING PROCEDURES

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UMKHANYAKUDE DISTRICT MUNICIPALITY TENDER INVITATION FOR THE UPGRADE OF COMMAND RESERVOIR AND WATER RETICULATION - HLUHLUWE PHASE 2
SCMU 005/2025/2026

The uMkhanyakude District Municipality seeks to appoint an experienced and suitably qualified contractor, from the panel of contractors, for the UPGRADE OF COMMAND RESERVOIR AND WATER RETICULATION - HLUHLUWE PHASE 2. It is estimated that tenderers should have a CIDB contractor **grading of 8CE or higher.** Only tenderers who are registered with the CIDB, or are capable of being registered prior to the closing date of the tender, in a contractor **grading of 8CE or higher**, will be eligible to tender. Tenderers must have experience in laying welded steel pipelines, laying of medium pressures uPVC pipelines and construction of valve chambers and reservoirs.

All service providers intending to submit a tender are required to register for inclusion on the District's Service Provider Database. Forms are obtainable from the District's Supply Chain Management Office. Tender documents can be downloaded from the National Treasury website: etenders@gov.za

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A compulsory briefing meeting will be held at **09h00 on 11 November 2025** at the **Mfekayi UKDM Water Satellite Office** Attendance at this briefing session is mandatory for all prospective tenderers.

Immediately following the briefing, a compulsory site inspection will be undertaken in the following sequence:

1. **Hluhluwe Water Treatment Works** (WTW) – commencement point of the project.
2. **Command Reservoir Site** – location of the proposed 4 ML additional reservoir.
3. **Mfekayi** – location of the proposed 4 ML service reservoir.

Tender submissions must be properly bound and placed in the tender box situated at the main office entrance of the uMkhanyakude District Municipality, Harlingen No:13433, Kingfisher Road, Mkuze, 3965, before 12h00 on Tuesday, 18 November 2025, in a sealed envelope which is clearly marked with the Tender Number and Tender Description. Late quotations or Tenders received by way of Facsimile or E-Mail will under no circumstances be considered.

Tenderers shall take note of the following Tender Conditions:

- uMkhanyakude District Municipality Supply Chain Management Policy will apply,
- uMkhanyakude District Municipality does not bind itself to accept the lowest tender or any other tender and reserves the right to accept the whole or part of the tender,
- Price(s) quoted must be valid for at least 12 weeks from date of your offer.
- Price(s) quoted must be firm and must specify whether inclusive of VAT (if a VAT vendor).
- The Single Envelope System shall apply.
- The 90/10-point system shall apply.

PREFERENCE SYSTEM		
PRICE	**90**	
SPECIFIC GOALS	**10**	
Specific Goal	**Sub-Points**	**Documents Required to Claim These Points.**
Enterprise owned by Black People ≥ 51%	2	**Certified CK/CSD/ID Documents**
Enterprise owned by Women ≥ 51%	2	**Certified CK/CSD/ID Documents**
Enterprise owned by Youth ≥ 51%	2	**Certified CK/CSD/ID Documents**
Enterprise owned by Disabled Persons ≥ 51%	2	**Medical Certificates Signed By Medical Practitioner**
Enterprise owned by SMME's – QSE and EME	2	**CSD**

FUNCTIONALITY
The following criteria will be used as the criteria for appointment of the service provider.
A bidder must score a minimum of 60% in respect of pre-qualification to be considered for evaluation/ functionality.

	CRITERION	MAXIMUM POINTS
1.	Experience Applicable to Past 5 years	15%
2.	Financial Resources	16%
3.	Key Personnel	17%
4.	Quality Assurance	10%
5.	Previous Performance	42%
Total		**100%**

Please ensure that the following compulsory documentation are attached:
Proof of compliance with their tax obligations with the South African Revenue Service (SARS); Proof of registration with the central supplier database (CSD); Proof of registration with CIDB; Proof of Good Standing with Municipal Account / Municipal Statement or Lease Agreement; MBD 4 – Declaration of Interest; MBD 5 Declaration for procurement above R10 Million; MBD 6.1 – Specific Goals; MBD 7.2 Contract form; MBD 8 – Declaration of bidders past SCM practices; and MBD 9 – Independent Bid Determination.

All bid documentation must be completed in its entirety and signed. Failure to submit the above documentation will disqualify your bid. Bidders must indicate their registered business address for the municipality to validate the good standing with municipal accounts.

UMkhanyakude District Municipality does not bind itself to accept the lowest quotation and reserves the right to accept the whole or any part of the quotation. This Bid is subject to the General Conditions of Contract (GCC) 2010 and, if applicable, any other Special Conditions of Contract.

All administrative enquiries are to be directed to SCM Manager, **Mr. Kenneth Ntshangase** via email at scm@ukdm.gov.za, Telephone: 035 573 8600. All technical enquiries are to be directed to **Mr. Nhlanhla Gumede**, Zimile (Pty) Ltd, via email at nhlanhlag@zimile.co.za or telephone 039 940 6729.

DR. SR NTULI
ACTING MUNICIPAL MANAGER

T1.2 TENDER DATA

GENERAL

The Conditions of Tender applicable to this contract are the Standard Conditions of Tender as contained in Annexure F of the CIDB *Standard for Uniformity in Construction Procurement, July 2015*. This document is obtainable separately. Tenderers shall obtain their own copies.

The Tender Data make several references to the Standard Conditions of Tender for details that apply specifically to this tender. The Tender Data shall have preference in the interpretation of any ambiguity or inconsistency between it and the Standard Conditions of Tender.

Each item of Tender Data given below is cross-referenced to the relevant clause in the Standard Conditions of Tender to which it mainly applies.

CLAUSE No	
F.1	**GENERAL**
F.1.1	**Actions**
	The Employer for this Contract is: Name : uMkhanyakude District Municipality Address :Private Bag 449 MKUZE 3965 Telephone No : (035) 573 8600 Fax No : (035) 573 8730
F.1.2	**Tender Documents**
	(a) The Tender Document, comprising two volumes, consists of the following **<u>THE TENDER(Volume1)</u>** **T1: Tendering Procedures** T1.1: Tender Notice and Invitation to Tender T1.2: Tender Data **T2: Returnable Documents** T2.1: List of Returnable Documents T2.2: Returnable Schedules and Documents

` **THE CONTRACT**

Part 1: Agreements and Contract Data

C1.1: Form of Offer and Acceptance

C1.2: Contract Data

C1.3: Performance Security

C1.4: Agreement in terms of the OHS Act No 85 of 1993

C1.5: Transfer of Rights and Indemnity in terms of GCC 6.10.1.5

C1.6: Adjudicator's Certificates

Part 2: Pricing Data

C2.1: Pricing Instructions

C2.2: Bill of Quantities

Part 3: Scope of Work

C3.1: Description of the Works

C3.2: Engineering

C3.3: Procurement

C3.4: Construction Specifications

C3.5: Management

C3.6: Standard Specifications

C3.7: Project Specifications (Variations to Standard Specifications)

C3.8: Particular Specifications

Part 4: Site Information

C4.1: Geotechnical

C4.2: Atmospheric/Climatic

C4.3: Environmental

C4.4: Locality Plan

C4.5: Nameboard Drawing

C4.6: Standard Drawings

	The Tender Document shall be obtained from the Employer's Agent at the physical address stated in the Tender Notice. In addition, the following documents, which are obtainable separately, are also referred to and are deemed to form part of this tender. **(b) "General Conditions of Contract for Construction Works – 3rd Edition 2015"** This document is issued by the South African Institution of Civil Engineering. (Short title "General Conditions of Contract 2015") and is obtainable separately. Tenderers shall obtain their own copies. **(c) "Standardised Specifications for Civil Engineering Construction" SABS 1200** This document is obtainable separately, and Tenderers shall obtain their own copies of the applicable sections. **(d) The Occupational Health and Safety Act N° 85 of 1993 and Amendment Act N° 181 of 1993, and the Construction Regulations 2014 (Government Gazette N° 37305 of 07 February 2014, Notice N° R84)** This document is obtainable separately, and Tenderers shall obtain their own copies. **(e)** In addition, Tenderers are advised, in their own interest, to obtain their own copies of the following acts, regulations, and standards referred to in this document, as they are essential for the Tenderer to get acquainted with the basics of construction management, the implementation of preferential construction procurement policies, and participation of targeted enterprises and labour. (i) The Construction Industry Development Board Act No 38 of 2000 and the Regulations in terms of the CIDB Act 38/2000, as at the closing time of this Tender, (ii) SANS 1921:2004 Construction and Management Part 1: General Engineering and Construction Works. Part 2: Accommodation of Traffic on Public Roads occupied by the Contractor. Part 6: HIV & AIDS Awareness. (iii) SANS 10396:2003 Implementing Preferential Construction Procurement Policies using Targeted Procurement Procedures (iv) SANS 1914:2003 Targeted Construction Procurement, Parts 1 to 6, dealing with Participation of Targeted Enterprises, Joint Ventures, Targeted Labour, etc. **(f)** The **uMkhanyakude District Municipality** Supply Chain Management Policy in terms of Section III of the Local Government Municipal Finance Management Act (Act No. 56 of 2003).
F.1.4	**Communication, Employer's Agent and Employer** **The Employer's Agent's details are as follows:**
	Name : Zimile Consulting Engineers Address : 1 George Macfarlane Ln, Townhill, Pietermaritzburg, 3201

	Tel. : 039 940 6729 Cell : 067 223 7415 E-mail address : nhlanhlag@zimile.co.za
	The Employer's details are as follows: Physical address: Stand 13433 Kingfisher Road MKUZE 3965 Postal address: Private Bag 449 MKUZE 3965 Contact Person : Mr Sbusiso Hlatshwayo Email : hlatshwayo.ukdm@gmail.com Contact numbers: Tel. : (035) 573 8600 Fax : (035) 573 8730
F.1.5	**The Employer's right to accept or reject any tender offer**
	The Employer is not obliged to accept the lowest or any tender offered.
F.2	**TENDERER'S OBLIGATIONS**
F.2.1	**Eligibility**
	A Tenderer will only be eligible to submit a tender if he/she meets all of the following criteria: (a) Only those Tenderers who are registered with the CIDB in a contractor grading designation equal to or higher than 8CE determined in accordance with Regulations 25 (1B) or 25 (7A) of the Construction Industry Development Regulations, for a CE class of construction work, are eligible to have their tenders evaluated (b) Joint ventures are eligible to submit tenders provided that: 1. every member of the joint venture is registered with the CIDB 2. the lead partner has a contractor grading designation in the CE class of construction work.

	3. the combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than the contractor grading designation required. 4. a valid Joint Venture Agreement is included with the tender, which shall be based on the CIDB Sample JV Agreement and shall include a clause to the effect that when the JV is dissolved the Lead Partner will remain liable in terms of the Contract including responsibility for latent defects and that this liability will continue for 10 years after completion of the Contract. 5. the Lead Partner shall be nominated in the returnable documents and accepts all liability in terms of the Contract. (c) Only those tenderers who demonstrate by providing evidence that they have in their employ management and supervisory staff satisfying the requirements of the scope of work for supervisory and management staff are eligible to submit tenders.
F.2.11	**Alterations to documents**
	A Tender offer shall not be considered if the document has been taken apart from the original binding. A Tender offer shall not be considered if alterations have been made to the offer or contract data (unless such alterations have been duly authenticated by the Tenderer) or if any particulars required therein have not been completed in all respects. The tender shall be completed in full in ink. Use of correction fluid is not permitted, and the presence of correction fluid in the tender shall render the tender invalid
F.2.12	**Alternative tender offers**
	Alternative tender offers will not be accepted.
F.2.13	**Submitting a Tender Offer**
F.2.13.2	Tenderers to note that the returnable documents are listed in T.2 (Returnable Documents).
F.2.13.3	Tender offers shall be submitted as an original only. Under no circumstances whatsoever may the tender forms be retyped or redrafted.
F.2.13.5	**Delivery of Tender**
	The Employer's address for delivery of tender offers and identification details to be shown on each tender offer package are: Location of tender box : Foyer, uMkhanyakude District Municipality Building Physical address : Stand 13433, Kingfisher Road, Mkuze, 3965 Identification detail : Upgrade of Command Reservoir &Water Reticulation- Hluhluwe Phase 2 Closing Date : 18 November 2025 Closing Time of tender : 12:00 Under no circumstances must documents be handed to an employee of uMkhanyakude District Municipality or handed in at the Procurement Department. Tender documents sent via courier

	services must also be deposited in the Tender Box and not handed to an employee of uMkhanyakude District Municipality. Late tenders and tenders not in the tender box at the time of opening will not be accepted by the District Municipality and will be returned to the applicant unopened. **NB: uMkhanyakude District Municipality will not accept responsibility for tender documents which are not deposited in the Tender Box.**
F.2.13.6	A two-envelope procedure will **NOT** be followed. (Read with F.3.5 hereafter).
F.2.13.9	Telephonic, telegraphic, telex, facsimile or e-mailed tender offers will not be accepted.
F.2.14	**Information and Data to be complete in all respects**
	The tender shall be completed in full in ink. In the Bill of Quantities, a price or rate shall be entered against each item where provision is made for such pricing whether quantities are stated or not. No two or more items may be bracketed together for a single price or rate as this will invalidate the tender. Items against which N/A or – is entered, or which are left blank, are to be considered as incomplete and will invalidate the tender. Items against which NIL or zero (0) is entered are to be considered as fully priced and the tenderer will provide the items in question at zero (0) or NIL price.
F.2.15.1	**Closing Time**
	The closing time for submission of Tender Offers is as per the Tender Notice and Invitation to Tender.
F.2.16.1	**Tender Offer Validity**
	The Tender Offer validity period is **30 days** from the closing time for submission of tenders.
F.2.17	**Clarification of Tender Offer after Submission**
	Clarification of a Tender Offer in response to a request to do so from the Employer during the evaluation of Tender Offers must be provided within two working days of the Employer's request, failing which the Employer may regard the Tender Offer as being non-responsive. **Arithmetical errors, omissions, discrepancies and imbalanced unit rates** Check responsive tenders for discrepancies between amounts in words and amounts in figures. Where there is a discrepancy between the amounts in figures and the amount in words, the amount appearing in the summary to the Pricing Schedule shall govern. Check responsive tender offers for: a) the gross misplacement of the decimal point in any unit rate.

	b) omissions made in completing the pricing schedule or bills of quantities; or c) arithmetic errors in: i) line-item totals resulting from the product of a unit rate and a quantity in bills of quantities or schedules of prices; or ii) the summation of the prices. d) imbalanced unit rates. Notify shortlisted tenderers of all errors, omissions or imbalanced rates that are identified in their tender offers. Where the tenderer elects to confirm the errors, omissions or re-balancing of imbalanced rates the tender offer shall be corrected as follows: a) If bills of quantities or pricing schedules apply and there is an error in the line-item total resulting from the product of the unit rate and the quantity, the unit rate shall govern, and the line-item total shall be corrected. Where there is an obviously gross misplacement of the decimal point in the unit rate, the line-item total as quoted, and the unit rate shall be corrected. b) Where there is an error in the total of the prices either as a result of other corrections required by this checking process or in the tenderer's addition of prices, the total of the prices shall be corrected. c) Where the unit rates are imbalanced adjust such rates by increasing or decreasing them and selected others while retaining the total of the prices derived after any other corrections made under (a) and (b) above. Where there is an omission of a line item, no correction is possible, and the offer may be declared non-responsive. Declare as non-responsive and reject any offer from a tenderer who elects not to accept the corrections proposed and subject the tenderer to the sanction under 4.16.2 of SANS 10845-3 The tenderer is required to submit balanced unit rates for rate only items in the pricing schedule. The rates submitted for these items will be taken into account in the evaluation of tenders.
F.2.18	**Provide Other Material**
	The tenderer shall, when requested by the Employer to do so, submit the names of all management and supervisory staff that will be employed together with satisfactory evidence that such staff members satisfy the eligibility criteria. Should the tenderer not provide the material, or a satisfactory reason as to why it cannot be provided, within two working days of the Employer's request, the Employer may regard the Tender Offer as being non-responsive.
F.2.19	**Inspections, tests and analyses**
	Access shall be provided for inspections and testing by personnel acting on behalf of the Employer on request.

F.2.20	**Sureties, Bonds and Policies**
	The tenderer is required to submit with his tender a letter of intent from an approved insurer undertaking to provide the Performance Bond to the format included in Part T2.2 of this procurement document.
F.2.22	**Return of Tender Documents**
	Where a tenderer who received a tender document does not submit a tender, the tender documents issued to him must be returned to the Employer within 28 days after the closing date for submission of tenders.
F.2.23	**Certificates**
	The tenderer shall submit with his tender the Certificates as called for in Section T2 – Returnable Documents. Proof of qualifications and other documentation required shall only be accepted on the basis of originals and certified copies of certificates and other documents.
F.3.4	**Opening of Tender Submissions**
	Tenders will be opened immediately after closing time of tenders (see Tender Notice and Invitation to Tender) at the location of the tender box.
F.3.5	**Two-envelope system**
	The two-envelope system will NOT be followed for this contract.
F.3.11	**Evaluation of Tender Offers**
	The Tenders will first be evaluated for functionality assessed in terms of objective criteria for experience, financial resources, key personnel, quality assurance and previous performance as per the scorecard below. Tenderers must achieve a minimum Quality Score of 60% for their tenders to be accepted for further evaluation in terms of Method 2, Financial Offer and Preference. The Functionality criteria and maximum score in respect of each criteria are as follows: 1. Experience Applicable to Past 5 years 15 points 2. Financial Resources 16 points 3. Key Personnel 17 points 4. Quality Assurance 10 points 5. Previous Performance 42 points Total possible points 100 points Tenderer's score = $\frac{\text{Tenderer's Points Scored}}{\text{Total possible points (100)}} \times 100$ Only tenderers scoring 60% or more for the quality (functionality) scorecard included in Section M in T2.2.1 will be eligible for further evaluation. *See Returnable Documents T2.2.1 Section M.*
F.3.11.3	**Method 2: Financial Offer and Preference**

	The formula to be used for calculating the price and preference shall be: • 90 points are allocated for price – W_t = 90 points • 10 points are allocated for B-BBEE status level of contribution – N_p (maximum) = 10 points. For Tenders of value exceeding R50 000 000 (inclusive of VAT).
F.3.11.7	**Scoring price**
	The formula to be used for calculating the value of A shall be Formula 2 Option 2.
F.3.11.8	**Scoring preferences**
	Points for preference will be scored as set out in Returnable Documents T2.2.1 Section N. The tenderer is to complete this Section to claim points for B-BBEE Status Level.
F.3.11.9	**Scoring Functionality**
	Functionality is an Eligibility Criterion. Only tenderers scoring 60% (60 points) or more for functionality as detailed in F2.1 and included in Section B in T2 will be eligible for tender and evaluated for Price and Preference.
F.3.13	**Acceptance of Tender Offer**
F.3.13.1	Tender Offers will only be accepted if, in addition to the conditions listed in the Standard Conditions of Tender. (a) The Tenderer has purchased the tender documents as stated in the Tender Advertisement and Notice to Tenderers. *See Returnable Documents T2.2.1 Section B.* (b) The Tenderer has attended the compulsory briefing meeting. *See Returnable Documents T2.2.1 Section C.* (c) The tenderer has the legal capacity to enter into the Contract and the signatory to the tender has the legal capacity to sign the tender. *See Returnable Documents T2.2.1 Section D.* (d) The Tenderer is in good standing financially, and is not • Insolvent • in receivership • bankrupt • being wound up • having his affairs administered by a court or a judicial officer • suspending his business activities • subject to legal proceedings in respect of the foregoing. Tenderers are required to submit a Bank Rating with this tender. *See Returnable Documents T2.2.1 Section E.*

(e) The Tenderer can provide proof that he/she is in good standing with respect to duties, taxes, levies and contributions required in terms of legislation applicable to the work in the contract.

See Returnable Documents T2.2.1 Section F.

(f) The Tenderer can demonstrate that he/she possesses the necessary professional and technical qualifications and competent, financial resources, equipment and other physical facilities, managerial capability, personnel, experience and reputation to perform the contract.

See Returnable Documents T2.2.1 Sections G and T2.2.2 Sections R, S and T.

(g) The Tenderer or any of its principals, directors or managers is not employed in the service of the State or any municipality. In the event that such principals are involved, official approval from the Executing Authority regarding carrying out remunerative work outside of the public service must be included in the tender submission.

The tenderer must complete the Declaration of Interest and the Compulsory Enterprise

Questionnaire and there are no conflicts of interest which may impact on the tenderer's ability to perform the contract in the best interests of the employer or potentially compromise the tender process.

See Returnable Documents T2.2.1 Section H.

(h) The Tenderer must demonstrate that he/she is able to arrange an acceptable performance guarantee should he/she be awarded the contract.

See Returnable Documents T2.2.1 Section I and Performance Guarantee Section C1.3.

(i) The Tenderer must confirm that he/she has the necessary competencies and resources to carry out the work safely in accordance with the Occupational Health and Safety Act, N° 85 of 1993, and the OSHA 1993 Construction Regulations 2014.

See Returnable Documents T2.2.1 Section J.

(j) The Tenderer and his principals are not under any restriction to participate in the Employers procurement due to corrupt or fraudulent practices.

See Returnable Documents T2.2.1 Section K.

(k) The tenderer is up to date with the payment of their Municipal Accounts and Rates.

See Returnable Documents T2.2.1 Section L.

(l) The tenderer or any of its directors/shareholders is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector.

(m) The Employer is satisfied that the Tenderer or any of his principals have not influenced the tender offer and acceptance by the following criteria:

	• having offered, promised or given a bribe or other gift or remuneration to any person in connection with the obtaining or execution of this contract. • having acted in a fraudulent or corrupt manner in obtaining or executing this contract. • having approached an officer or employee of the Employer or the employer's Agent with the objective of influencing the award of a contract in the Tenderer's favour. • having entered into any agreement or arrangement, whether legally or not, with any other person, firm or company to refrain from tendering for this contract or as to the amount of the Tender to be submitted by either party. • having disclosed to any other person, firm or company other than the Employer, the exact or approximate amount of his proposed Tender. (n) The Tenderer is judged 'eligible' in terms of Clause F2.1. The Employer may, in addition to using any other legal remedies, repudiate the Tender offer and acceptance and declare the Contract invalid should it have been concluded already The Employer does not bind itself to accept the lowest or any tender. **Failure to sign the form of offer and acceptance will render the tender "non-responsive"**
F.3.18	**Copies of contract** The number of paper copies of the signed contract to be provided by the Employer is: **one**.

T2: RETURNABLE DOCUMENTS

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T2.1:	List of Returnable documents		T2.2
T2.2:	Returnable Schedules and Documents		T2.3

T2.1 LIST OF RETURNABLE DOCUMENTS

The Tender Document must be submitted as a whole. All forms must be properly completed as required, and the document shall not be taken apart or altered in any way whatsoever.

The list of returnable documents comprises the following: tick ✔ ☐

1. RETURNABLE SCHEDULES AND OTHER DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES		
PART	**DESCRIPTION**	
A.	Details of Registration with CIDB	
B.	Proof of Purchase of Tender Documents	
C.	Certificate of Attendance at Site Meeting	
D	Certificate of Authority for Signatory	
D1.	Certificate for Company	
D2.	Certificate for Close Corporation	
D3.	Certificate for Partnership	
D4a.	Certificate of Authority for Joint Venture	
D4b.	Resolution of Board of Directors to enter into Consortia or Joint Ventures	
D4c.	Joint Venture Disclosure Form	
D5.	Certificate for Sole Proprietor	
E.	Tenderer's Financial Standing	
F1.	VAT Registration Certificate	
F2.	Tax Clearance Certificate Requirements (MBD2)	
F3.	Skills Development Levy Certificate	
F4.	Workmen's Compensation Registration Certificate	
F5.	Unemployment Insurance Fund (UIF) Registration Certificate	
G1.	Schedule of Similar Work Undertaken	
G2.	Schedule of Present Commitments	
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H2.	Declaration of Interest	
H3.	Declaration for Procurement above R10 million (MBD5)	

H4.	Declaration Certificate for Local Production and Content (MBD6.2)	
I.	Form of Intent to Provide a Performance Guarantee	
J.	Health and Safety Declaration	
K1.	Declaration of Tenderer's Past Supply Chain Management Practices - MDB8	
K2.	Certificate of Independent Bid Determination MBD 9	
L.	Municipal Account	
M.	Quality Scorecard (Functionality)	
N.	Preference Points – B BBEE Status Level (MBD 6.1)	
2. RETURNABLE SCHEDULES AND OTHER DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT		
O.	Record of Addenda to Tender Documents	
P.	Amendments, Qualifications and Alternatives	
Q1.	Preliminary Programme	
Q2.	Preliminary Cash Flow	
Q2.	Schedule of Plant and Equipment	
S.	Proposed Subcontractors	
T.	Key Personnel	

Note: Tenderer to tick off each box to ensure that the necessary schedules and documents have been filled in and are included into the tender document.

T2.2 RETURNABLE SCHEDULES AND DOCUMENTS

PART	DESCRIPTION	PAGE No.
T2.2.1	Returnable Schedules and Documents required for Tender Evaluation Purposes	T2.4
T2.2.1	Returnable Schedules and other Documents that will be incorporated into the Contract	T2.67
T2.2.1 RETURNABLE SCHEDULES AND DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES		
A.	Details of Registration with CIDB	T2.6
B.	Proof of Purchase of Tender Documents	T2.7
C.	Certificate of Attendance at Site Meeting	T2.8
D	Certificate of Authority for Signatory	T2.9
D1.	Certificate for Company	T2.10
D2.	Certificate for Close Corporation	T2.11
D3.	Certificate for Partnership	T2.12
D4a.	Certificate of Authority for Joint Venture	T2.13
D4b.	Resolution of the Board of Directors to enter into Consortia or Joint Ventures	T2.14
D4c.	Joint Venture Disclosure Form	T2.17
D5.	Certificate for Sole Proprietor	T2.24
D6	Contract Participation Goals	T2.25
E.	Tenderer's Financial Standing	T2.26
F1.	VAT Registration Certificate	T2.28
F2.	Tax Clearance Certificate Requirements (MBD2)	T2.29
F3.	Skills Development Levy Certificate	T2.31
F4.	Workmen's Compensation Registration Certificate	T2.32
F5.	Unemployment Insurance Fund (UIF) Registration Certificate	T2.33
G1.	Schedule of Similar Work Undertaken	T2.34
G3.	Assessment of Contractor's Performance by Independent Reference	T2.38
H1.	Compulsory Enterprise Questionnaire	T2.39
H2.	Declaration of Interest	T2.43
H3.	Declaration for Procurement above R10 million	T2.46
H4.	Declaration Certificate for Local Production and Content	T2.48
I.	Form of Intent to Provide a Performance Guarantee	T2.53

J.	Health and Safety Declaration	T2.54
K1.	Declaration of Tenderer's Past Supply Chain Management Practices - MDB8	T2.55
K2.	Certificate of Independent Bid Determination MBD 9	T2.55
L.	Municipal Account	T2.60
M.	Quality Scorecard (Functionality)	T2.62
N.	Preference Points – MBD 6.1	T2.71

A. DETAILS OF REGISTRATION WITH CIDB

PRIMARY CONTRACTOR

Contractor's Name: .....

Contractors CIDB Registration Number: .....

Contractors CIDB Registration Classification: .....

JOINT VENTURE PARTNER 1 (Where Applicable)

Contractor's Name: .....

Contractors CIDB Registration Number: .....

Contractors CIDB Registration Classification: .....

JOINT VENTURE PARTNER 2 (Where Applicable)

Contractor's Name: .....

Contractors CIDB Registration Number: .....

Contractors CIDB Registration Classification: .....

Note: This information will be checked on the CIDB Website

Date:..... **Signature of Tenderer: .....**

B. PROOF OF PURCHASE OF TENDER DOCUMENTS

[The Tenderer shall insert here proof of purchase of the tender documents in the form of an official receipt or other acceptable form of proof]

C. CERTIFICATE OF ATTENDANCE AT SITE MEETING

This will not be required as <u>ONLY</u> Contractor's who previously participated in this Bid have been invited to tender.

D. CERTIFICATE OF AUTHORITY FOR SIGNATORY

Indicate the status of the tenderer by ticking the appropriate box hereunder. The tenderer must complete the certificate set out below for the relevant category and **attach its required certificates to the page provided at the end of this form.**

	(a) COMPANY	**(b) CLOSE CORPORATION**	**(c) PARTNERSHIP**	**(d) JOINT VENTURE**	**(e) SOLE PROPRIETOR**
Status (✓ tick)					
Complete Section	D1	D2	D3	D4a,D4b,D4c, D4d	D5
Provide Certificates	Company Registration	Company Registration	Company Registration	Company Registration Agreements Power of Attorney	ID Document

Failure to provide all of the required information pertaining to the Joint Venture in the case of Tender Offers by Joint Ventures may result in the Tender Offer being judged nonresponsive and ineligible for evaluation.

D.1 CERTIFICATE FOR COMPANY

I, ... chairperson of the Board of Directors of .... hereby confirm that by resolution of the Board (copy attached) taken on ..... 20.....,

Mr/Ms.....acting in the capacity of ....., was authorised to sign all documents in connection with the tender for Contract No SCMU005/2025/2026 and any contract resulting from it, on behalf of the company.

Chairman: .....

As Witnesses: 1. .....

2. .....

Date: .....

D.2 CERTIFICATE FOR CLOSE CORPORATION

We, the undersigned, being the key members in the business trading as .....

..... hereby authorise Mr/Ms .....,

acting in the capacity of ....., to sign

all documents in connection with the tender for Contract No SCMU005/2025/2026 and any contract resulting from it, on our behalf.

NAME	ADDRESS	SIGNATURE	DATE

Note: This certificate is to be completed and signed by all of the key members upon whom rests the direction of the affairs of the Close Corporation as a whole.

Signed: .....

As Witnesses: 1. .....

2. .....

Date: .....

D.3 CERTIFICATE FOR PARTNERSHIP

We, the undersigned, being the key partners in the business trading as, ...

..... hereby authorise Mr/Ms .....

acting in the capacity of ....., to sign all documents in connection with the tender for Contract No SCMU005/2025/2026 and any contract resulting from it, on our behalf.

NAME	ADDRESS	SIGNATURE	DATE

Note: This certificate is to be completed and signed by all of the key partners upon whom rests the direction of the affairs of the Partnership as a whole.

As Witnesses: 1. .....

2. .....

Signed:

.....

Date: .....

D.4a CERTIFICATE OF AUTHORITY FOR JOINT VENTURE

We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorize Mr/Ms, ... authorized signatory of the company..... acting in the capacity of lead partner, to sign all doc uments in connection with the tender offer for Contract No SCMU005/2025/2026 and any contract resulting from it, on our behalf.

This authorization is evidenced by the attached power of attorney signed by legally authorized signatories of all the partners to the Joint Venture.

NAME OF FIRM	ADDRESS	AUTHORISING SIGNATURE, NAME AND CAPACITY
Lead Partner		
JV Partner 1		
JV Partner 2		

Note: This certificate is to be completed and signed by all of the key partners upon whom rests the direction of the affairs of the Partnership as a whole.

Signed: .....

As Witnesses: 1. .....

2. .....

Date: .....

D.4b RESOLUTION OF BOARD OF DIRECTORS TO ENTER INTO CONSORTIA OR JOINT VENTURES

(IF APPLICABLE)

Resolution of a meeting of the Board of Directors/Members/Partners* of:

_____

_____

(Legally correct full name and registration number, if applicable, of the Enterprise)

Held at _____ (place) on _____ (date)

Resolved that:

1. The Enterprise submit a Bid/Tender, in consortia/joint venture with the following enterprise:

   _____

   _____

   (List all the legally correct full names and registration numbers, if applicable, of the Enterprises forming the consortia/joint venture)

   to the Employer and for the work explained in the Scope of Work for Contract Contract No SCMU005/2025/2026

2. Mr/Mrs/Miss/Ms*:

   _____

   in his/her* capacity as: _____ (position in the Enterprise) and who will sign as follows: _____

   be, and is hereby, authorised to sign a consortium/joint venture agreement with the parties listed under item 1 above, and any and all other documents and/or correspondence in connection with and relating to the consortium/joint venture, in respect of the project described under Item 1 above.

3. The Enterprise accepts joint and several liability with the parties listed under item 1 above for the due fulfilment of the obligations of the joint venture/consortium deriving from, and in any way connected with, the Contract to be entered into with the Employer in respect of the project described under Item 1 above.

The Enterprise chooses as its *domicilium citandi et executandi* for all purposes arising from this joint venture/consortium agreement and the Contract with the Employer in respect of the project under Item 1 above:

Physical address: _____

_____

_____

_____

_____ (code)

Postal address: _____

_____

_____

_____ (code)

Telephone: _____(with code)

Fax: _____ (with code)

Email: _____

	Name	Enterprise	Capacity	Signature
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				

Note: 1. * Delete which is not applicable

2. This resolution must be signed by all the Directors/Members/Partners of the Bidding Enterprise.

3. Should the number of Directors/Members/Partners exceed the space available above, additional names and signatures must be added on a separate page.

Signed: .....

As Witnesses: 1. . .....

2. .....

Date: .....

D.4c JOINT VENTURE DISCLOSURE FORM (TO BE COMPLETED IN CASE OF TENDER BY JV)

Note:

1) All the information requested must be filled in the spaces provided. If additional space is required, additional sheets may be attached.
2) A copy of the formal joint venture agreement must be attached to this form. In order to demonstrate the partner's share in the ownership, control, management responsibilities, risks and profits of the joint venture, the proposed joint venture agreement must include specific details relating to:
   i) the contributions of capital and equipment
   ii) work items to be performed by the Partners.
   iii) work item to be performed under the supervision of the Partner
3) Copies of all written agreements between partners concerning the contract must be attached to this form including those which relate to ownership options and to restrictions/limits regarding ownership and control.
4) Should any of the above not be complied with, the joint venture will be deemed null and void and will be considered non-responsive.

1) JOINT VENTURE PARTICULARS.

1.1 a) Name of Firm .....

b) Postal Address .....

c) Physical Address: .....

d) Telephone: .....

e) Fax: .....

2) IDENTITY OF EACH NON-ABE PARTNER

2.1 a) Name of Firm .....

b) Postal Address .....

c) Physical Address: .....

d) Telephone: .....

e) Fax: .....

2.2 a) Name of Firm: .....

b) Postal Address .....

c) Physical Address: .....

d) Telephone: .....

e) Fax: ....

3) BRIEF DESCRIPTION OF THE ROLES OF THE PARTNERS IN THE JOINT VENTURE

....

....

4) RECENT CONTRACTS EXECUTED BY PARTNERS IN THEIR OWN RIGHT OR AS PARTNERS OTHER JOINT VENTURES.

a) ....

b) ....

c) ....

d) ....

e) ....

5) CONTROL AND PARTICIPATION IN THE JOINT VENTURE

(Identify by name and firm those individuals who are, or will be, responsible for, and have authority to engage in the relevant management functions and policy and decision making, indicating any limitations in their authority e.g. co-signature requirement and Rand limits).

a) Joint Venture cheque signing

....

....

b) Authority to enter into contracts on behalf of the Joint Venture.

.....

c) Signing, co-signing and/or collateralising of loans.

.....

.....

.....

d) Acquisition of lines of credit.

.....

.....

.....

e) Acquisition of performance bonds.

.....

.....

.....

f) Negotiating and signing labour agreements.

.....

.....

.....

6) MANAGEMENT OF CONTRACT PERFORMANCE

(Fill in the name and firm of the responsible person).

a) Supervision of field operations.....

.....

b) Major purchasing .....

.....

c) Estimating

.....

.....

d) Technical management

.....

.....

7) MANAGEMENT AND CONTROL OF JOINT VENTURE

a) Identify the "managing partner", if any.

.....

.....

.....

.....

b) What authority does each partner have to commit or obligate the other to financial institutions, insurance companies, suppliers, subcontractors and/or other parties participating in the execution of the contemplated works?

.....

.....

.....

.....

c) Describe the management structure for the Joint Venture's work under the contract

MANAGEMENT FUNCTION/ DESIGNATION	NAME	PARTNER (EX NON-ABE/EX ABE) *

8) PERSONNEL

a) State the approximate number of operative personnel (by trade/function/discipline) needed to perform the Joint Venture work under the Contract.

TRADE/FUNCTION/ DISCIPLINE	NUMBER LEAD PARTNER	NUMBER PARTNER 1

b) Number of operative personnel to be employed on the contract who are currently in the employ of partners.

i) Number currently employed by Lead Partner .....

ii) Number of currently employed by Partner 1.....

c) Number of operative personnel who are not currently in the employ of the respective partners and will be engaged on the project by the Joint Venture

.....

d) Name of individual who will be responsible for hiring Joint Venture employees

....

e) Name of partner who will be responsible for the preparation of Joint Venture payrolls

....

9) CONTROL AND STRUCTURE OF THE JOINT VENTURE

Briefly describe the manner in which the Joint Venture is structured and controlled.

....

....

....

....

....

The undersigned warrants that she/he is dully authorised to sign this Joint Venture Disclosure Form and affirms that the foregoing statements are correct and include all material information necessary to identify and explain the terms and operations of the Joint Venture and the intended participation of each partner in the undertaking.

The undersigned further covenants and agrees to provide the Employer with complete and accurate information regarding actual Joint Venture work and the payment therefore, and any proposed

changes in any provisions of the Joint Venture agreement, and to permit the audit and examination of the books, records and files of the Joint Venture, or those of each partner relevant to the Joint Venture, by duly authorised representatives of the Employer.

Signature .....

Duly authorised to sign on behalf of .....

Name .....

Address .....

. .....

Telephone .....

Date .....

Signature .....

Duly authorised to sign on behalf of.....

Name .....

Address.....

.....

Telephone .....

Date .....

D.5 CERTIFICATE FOR SOLE PROPRIETOR

I, ..., hereby confirm that I am the sole owner of the business trading as .....

Signature of Sole owner: .....

As Witnesses:

1. .....

2. .....

Date: .....

D6 CONTRACT PARTICIPATION GOALS

Objective

The objective of Umkhanyakude District Municipality's empowerment initiative is to bring about meaningful transformation in all procurement projects and in particular in the built environment / construction and consulting industry through achieving one or more of the following objectives:

- Meaningful Economic Participation;
- Local Economic Development;
- Transfer of Technical, Management and Entrepreneurial Skills; and
- Creation of sustainable Black Enterprises

Contract Participation Goals

Contract Participation Goal (CPG) – the final value of services paid to the CPG Partner/s based on the final contract value.

At the time of awarding the contract the 30% minimum CPG amount will be based on the contract award value exclusive of the following:

- VAT, CPA and Contingencies.

During contract implementation, adjustments relating to Provisional Sums and Contingencies linked to the CPG allocation will be agreed upon between the parties to the contract, as and when the need arises.

CPG Partner/s – Umkhanyakude District Municipality will provide or arrange a CPG Partner/s to work with the successful company.

Tenderers are required to achieve at least 30% Contract Participation Goals (CPG) including a minimum 10% Black Women participation and another 10% for Local participation of the value of goods, services and Works paid to one or more enterprises (CPG Partner/s)

- 30% includes any special materials
- 30% excludes VAT, CPA and Contingencies.
- The tenderer will be required to achieve the actual Rand value committed for CPG, adjusted according to the following:

o Variation Orders – Each VO will be evaluated by the Employer's Agent and the Project Manager to determine whether it should be counted, in its entirety or partially, as part of CPG or not.

o Re-measureable Items (including CPA, and provisional sums) – Each re-measureable item change will be evaluated by the Employer's Agent and the Project Manager to determine whether it should be counted as part of CPG or not.

Within 2 weeks of the award of contract, the tenderer will be required to submit a cash flow projection for the main contractor and the CPG Partner/s

Applicability

The CPG target is applicable to all contracts to be adjudicated through the Umkhanyakude District Municipality procurement process and shall be achieved through the following mechanisms:-

- CPG Partner/s selection is concluded after adjudication of tenders and before contract award is made.
- The CPG Partner/s shall be selected according to the following criteria:

o CPG Partner/s are to be obtained from Umkhanyakude District Municipality's database of Service Providers specifically earmarked for CPG purposes.

o In the event of services where Umkhanyakude District Municipality does not have an applicable service provider on its database, the tenderer may propose a suitable CPG Partner/s for consideration by Umkhanyakude District Municipality.

- Main service provider may propose a suitable CPG Partner/s, but Umkhanyakude District Municipality reserves the right to provide or arrange a CPG Partner/s to work with the successful company.
- Sub-contracting of the CPG Partner/s at the same rate / price that the tenderer would have offered to Umkhanyakude District Municipality whilst making profit margins consistent to the profit margins that the main Service Provider would have made under normal trading processes.
- Value of the work to be sub contracted shall be at least **30% (minimum of 10% shall be due to Black Women participation and another 10% for Local participation)** of the total contract value excluding VAT, CPA and Contingencies.
- CPA is payable to the CPG Partner/s as per the indices stipulated in the contract document.
- The work allocated to the CPG Partner shall be performed by the CPG Partner directly and may not be allocated or sub-contracted out to other contractors/consultants/service providers.
- The main Service Provider **shall not** substitute any CPG Partner/s without the written approval of Umkhanyakude District Municipality.
- The working capital arrangements between the main Service Provider and the CPG Partner/s must be agreed upon between the two parties prior to commencement of works to ensure that the CPG Partner does not have cash flow challenges during contract implementation.

Invoicing and Payment

The monthly measurement and payment will be according to the following guideline:

- Submission of payment certificate by the Service Provider– by 30th of each month, or the nearest previous working day. The submission from the Service Provider shall include the signature of the CPG Partner indicating agreement with the measurements and rates applicable to the work undertaken by the CPG Partner.
- Payment to the Service Provider – on the last day of the following month;
- The CPG Partner must be paid within reasonable time but no later than 3 working days after the Main Service Provider has been paid by Umkhanyakude District Municipality; and
- The submission from the Service Provider must include a schedule that clearly shows the following:
  - Total Contract Sum
  - Total amount payable to CPG Partner/s excluding current month
  - Amount payable to CPG Partner for current month
  - % split of Total amount payable to Main Service Provider and CPG Partner/s

Monitoring and Reporting on CPG

- Umkhanyakude District Municipality will monitor CPG implementation on site. This may include direct contact with CPG Partner/s on site for verification purposes.
- The CPG Partner shall be in agreement with the measurement and payment for work completed, for the purposes of submitting payment certificates, as determined by the Service Provider. Should disagreements arise, Umkhanyakude District Municipality reserves the right to intervene to resolve the disagreement.
- CPG Partner/s shall attend all contractual meetings relevant to their scope of work including contract award negotiations, monthly contract site meetings and technical meetings where applicable.

Eligibility Criteria

For tenders where the CPG target is applicable, those that do not offer a minimum CPG participation of 35% (including minimum 10% Black Women participation and another 10% for Local participation) according to the requirements mentioned above, will be deemed ineligible.

DECLARATION REGARDING CONTRACT PARTICIPATION GOALS

I, the undersigned, in submitting the accompanying bid:

_____

(Bid Number and Description)

in response to the invitation for the bid made by:

UMKHANYAKUDE DISTRICT MUNICIPALITY

do hereby make the following declaration and certify the statements contained herein to be true and complete in every respect:

I certify, on behalf of:_____that:
(Name of Bidder)

1. I have read and I understand the contents of this Declaration and the fully completed bid document accompanying this declaration;

2. I understand and declare that the accompanying bid will, and must, be disqualified if this Declaration is found not to be true and complete in every respect;

3. I understand and declare that in the event that this bid is successful, I will be required to, and shall, fully implement the commitments that are submitted with this bid, in particular regarding the Bidder's contract participation goals and commitments towards the allocation of certain portion of the contract to small and emerging entities. Failure to implement such commitments as outlined in the bid document (in particular, as detailed in the bill of quantities) and or failure to provide the relevant information within the prescribed period as determined in the Letter of Intention to Award the Bid, shall automatically disqualify this bid from further consideration and the Employer has the right to, and must, then award the bid to the next highest ranked bidder; and as a result I or the bidder or any of its directors shall have no recourse against Umkhanyakude District Municipality.

4. I am authorized by the bidder to sign this Declaration, and to submit the accompanying bid, on behalf of the bidder;

5. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign the bid, on behalf of the bidder;

6. I am aware that, and do consent to, the disqualification of my or the bidder's future bids with Umkhanyakude District Municipality in the event that the commitments made herein are not fulfilled and that such non-fulfillment amounts to abuse of Umkhanyakude District Municipality's supply chain policies and procedures and/or empowerment objectives which must be penalized, over and above the contractual sanctions as agreed to in line with the contract signed with Umkhanyakude District Municipality, with a sanction of restricting me and or my company (the bidder) and or any of its directors from conducting business with Umkhanyakude District Municipality for a period not exceeding ten (10) years.

7. I consent that should my company (the Bidder) deviate from the commitments and the spirit of the CPG objectives as agreed to, shall amount to a repudiation of the contractual arrangement between the two parties (Umkhanyakude District Municipality and the Bidder); and Umkhanyakude District Municipality shall have the right to terminate the contract with immediate effect and without giving my company (the Bidder) prior notice to remedy the breach.

_____	_____	_____
Full Names & Surname (Duly authorized)	Signature	Date
_____		_____
Position		Name of Bidder

REGISTRATION CERTIFICATE / AGREEMENT / ID DOCUMENT

[Important note to Tenderer: Registration Certificates for Companies, Close Corporations and Partnerships, or Agreements and Powers of Attorney for Joint Ventures, or ID documents for Sole Proprietors, all as referred to in the foregoing forms and in T2.1, must be inserted here]

E. TENDERER'S FINANCIAL STANDING

The Tenderer shall provide information about his commercial position, which includes information necessary for the Employer to evaluate the Tenderer's financial standing.

To that end, the Tenderer must provide with his tender, a bank rating, certified by his banker, to the effect that he will be able to successfully complete the contract at the tendered amount within the specified time for completion.

However, should the Tenderer be unable to provide a bank rating with his tender, he shall state the reasons as to why he is unable to do so, and in addition provide the following details of his banker and bank account that he intends to use for project:

Name of account holder: .....

Name of Bank: ..... Branch: .....

Account number: ..... Type of account: .....

Telephone number: ..... Facsimile number: .....

Name of contact person (*at bank:* .....

Failure to provide either the required bank details or a certified bank rating with his tender, will result in the tender being considered ineligible.

The Employer undertakes to treat the information thus obtained as confidential, strictly for the use of evaluation of the tender submitted by the Tenderer.

SIGNATURE: ..... DATE:..... *(of person authorised to sign on behalf of the Tenderer)*

E1. BANK RATING

[Attach rating here]

F1. VAT REGISTRATION CERTIFICATE

[The tenderer's VAT Registration Certificate to be inserted here].

F2. TAX CLEARANCE CERTIFICATE

TAX CLEARANCE CERTIFICATE REQUIREMENTS **MBD2**

It is a condition of bid that the taxes of the successful bidder must be in order, or that satisfactory arrangements have been made with South African Revenue Service (SARS) to
meet the bidder's tax obligations.

1 In order to meet this requirement bidders are required to complete in full the attached form TCC 001 "Application for a Tax Clearance Certificate" and submit it to any SARS branch office nationally. The Tax Clearance Certificate Requirements are also applicable to foreign bidders/individuals who wish to submit bids.

2 SARS will then furnish the bidder with a Tax Clearance Certificate that will be valid for a period of 1 (one) year from the date of approval.

3 The original Tax Clearance Certificate must be submitted together with the bid. Failure to submit the original and valid Tax Clearance Certificate will result in the invalidation of the bid. Certified copies of the Tax Clearance Certificate will not be acceptable.

4 In bids where Consortia / Joint Ventures / Sub-contractors are involved, each party must submit a separate Tax Clearance Certificate.

5 Copies of the TCC 001 "Application for a Tax Clearance Certificate" form are available from any SARS branch office nationally or on the website www.sars.gov.za.

6 Applications for the Tax Clearance Certificates may also be made via eFiling. In order to use this provision, taxpayers will need to register with SARS as eFilers through the website www.sars.gov.za.

APPLICATION FORM FOR TAX CLEARANCE CERTIFICATE

The application form has to be submitted to SARS to enable them to issue the required Tax Clearance Certificate. The original and valid Tax Clearance Certificate obtained from the SARS must be submitted with the tender

[Completed Application form to be inserted here].

NB: ***The application form has to be submitted to SARS to enable them to issue the required Tax Clearance Certificate. The original and valid Tax Clearance Certificate obtained from the SARS must be submitted with the tender (to be attached to the next page).***

TAX CLEARANCE CERTIFICATE

[Original Tax Clearance Certificate obtained from SARS to be inserted here].

F3. SKILLS DEVELOPMENT LEVY CERTIFICATE

[The Tenderer's Skills Development Levy Certificate to be inserted here].

F4. WORKMEN'S COMPENSATION REGISTRATION CERTIFICATE

[The tenderer's Workmen's Compensation Registration Certificate or proof of payment of contributions to be inserted here].

F5. UNEMPLOYMENT INSURANCE FUND (UIF) REGISTRATION CERTIFICATE

[The Tenderer's Unemployment Insurance Fund (UIF) Registration Certificate to be inserted here].

G1. a. SCHEDULE OF SIMILAR WORK UNDERTAKEN WITHIN LAST 5 YEARS

Principal Contractor

NAME: _____

Name of Similar Project Successfully Undertaken	Description	Date Completed	Contract Value R	Referees		
				Name	Position	Contact Details

Note: 1. Similar work (or Project) means welded steel pipelines.

2. Five of the projects listed in these Forms G1a and G1b must be used for the Quality Score Criteria 1 in Section M T2.2.1.

3. When evaluating the Quality Score, the Employer will contact the reference for any two or more of the projects listed and ask them to complete the "Assessment of Performance" form (see example G3). The Tenderer's score for Criteria 5 in Section M will be based on the reply.

Signature : _____ **Date:** _____

G1 b. SCHEDULE OF SIMILAR WORK UNDERTAKEN WITHIN LAST 5 YEARS

Joint Venture Partner

NAME: _____

Name of Similar Project Successfully Undertaken	Description	Date Completed	Contract Value R	Referees		
				Name	Position	Contact Details

Note: 1. If there is more than 1 Joint Venture Partner, the page is to be copied and completed for each additional Joint Venture.

2. Similar work (or Project) means welded steel pipelines.

3. Five of the projects listed in these Forms G1a and G1b must be used for the Quality Score Criteria 1 in Section M T2.2.1.

4. When evaluating the Quality Score, the Employer will contact the reference for any two or more of the projects listed and ask them to complete the "Assessment of Performance" form (see example G3). The Tenderer's score for Criteria 5 in Section M will be based on the reply

G2. PRESENT COMMITMENTS

Employer and Contract Description	Contract Amount	Duration and Completion Date	Consulting Engineer

Signature : _____ **Date:** _____

SAMPLE FORM

G3. ASSESSMENT OF CONTRACTOR'S PERFORMANCE BY INDEPENDENT REFERENCE

(This will be sent by the Employer to at least 2 of the references listed in Criteria 1 Section M Page T2.51 to obtain scores for Criteria 5a and 5b Pages T2.55 and T2.56)

Please assess the Contractor (Name:) ..... on his/her performance on the following Contract.

Contract No. .....

Name of Contract: ..... Year of execution: .....

Contract value: ..... Employer: .....

Contract duration: ..... Engineer: .....

Reference's Position in Contract: .....

Your assessment of the Contractor's performance in the following areas: *(please tick **one** of the blocks on the right-hand side)*	**Not true**	**Partially fulfilled**	**Substantially fulfilled**	**Completely fulfilled**
"Contractor's Management was adequate for the contract"				
"Contractor provided suitably qualified Site personnel"				
"Contractor complied with Health & Safety requirements"				
"Contractor's provided adequate resources for the contract"				
"Contractor's communication and compliance to instructions was good"				
"Quality of work produced was to drawings and specification"				
"Contract was completed on time"				

Any other comments:

.....

.....

.....

Name of person completing this assessment form (Reference): .....

ECSA Prof. Reg. No: ..... Representing firm: .....

Please return by fax to: ..... or e-mail to: .....

Signature of Reference/Validator..... Date of Assessment: .....

H1. COMPULSORY ENTERPRISE QUESTIONNAIRE

The following particulars must be furnished. In the case of a joint venture, separate enterprise questionnaires in respect of each partner must be completed and submitted.

Section 1: Name of enterprise: .....

Section 2: VAT registration number, if any: .....

Section 3: CIDB registration number, if any: .....

Section 4: Particulars of sole proprietors and partners in partnerships

Name*	**Identity number***	**Personal income tax number***

*Complete only if sole proprietor or partnership and attach separate page if more than 3 partners

Section 5: Particulars of companies and close corporations

Company registration number: .....

Close corporation number:
.....

Tax reference number: .....

Section 6: Record in the service of the state

Indicate by marking the relevant boxes with a cross, if any sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months in the service of any of the following:

a member of any municipal council		an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999)	
a member of any provincial legislature			
a member of the National Assembly or the National Council of Province			

a member of the board of directors of any municipal entity		a member of an accounting authority of any national or provincial public entity	
an official of any municipality or municipal entity		an employee of Parliament or a provincial legislature	

If any of the above boxes are marked, disclose the following:

Name of sole proprietor, partner, director, manager, principal shareholder or stakeholder	**Name of institution, public office, board or organ of state and position held**	**Status of service (tick appropriate column)**	
		Current	**Within last 12 months**

ınsert separate page if necessary

Section 7: Record of spouses, children and parents in the service of the state

Indicate by marking the relevant boxes with a cross, if any spouse, child or parent of a sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months in the service of any of the following:

a member of any municipal council		an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999)	
a member of any provincial legislature			
a member of the National Assembly or the National Council of Province			
a member of the board of directors of any municipal entity		a member of an accounting authority of any national or provincial public entity	
an official of any municipality or municipal entity		an employee of Parliament or a provincial legislature	

If any of the above boxes are marked, disclose the following:

Name of spouse, child or parent	Name of institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		Current	Within last 12 months

*insert separate page if necessary

The undersigned, who warrants that he/she is duly authorised to do so on behalf of the enterprise:

i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my/our tax matters are in order.

ii) confirms that neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004.

iii) confirms that no partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise, has within the last five years been convicted of fraud or corruption.

iv) confirms that I/we are not associated, linked or involved with any other tendering entities submitting tender offers and have no relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest; and

v) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

Signed: ..... Date: .....

Name: ..... Position: .....

Enterprise name: .....

H2. DECLARATION OF INTEREST

(MBD4)

DECLARATION OF INTEREST

1. No bid will be accepted from persons in the service of the state.
2. Any person, having a kinship with persons in the service of the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid. In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons connected with or related to persons in service of the state, it is required that the bidder or their authorised representative declare their position in relation to the evaluating/adjudicating authority and/or take an oath declaring his/her interest.
3. In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.

3.1 Full Name: .....

3.2 Identity Number:.....

3.3 Company Registration Number:.....

3.4 Tax Reference Number: .....

3.5 VAT Registration Number: .....

3.6 Are you presently in the service of the state **YES / NO**

3.6.1 If so, furnish particulars.

.....

.....

3.7 Have you been in the service of the state during the previous twelve months? **YES/ NO**

3.7.1 If so, furnish particulars.

.....

.....

 MSCM Regulations: "in the service of the state" means to be –

(a) a member of –

(i) any municipal council.

(ii) any provincial legislature; or

(iii) the national Assembly or the national Council of provinces.

(b) a member of the board of directors of any municipal entity.

(c) an official of any municipality or municipal entity.

(d) an employee of any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999); (e) a member of the accounting authority of any national or provincial public entity; or (f) an employee of Parliament or a provincial legislature.

3.8 Do you, have any relationship (family, friend, other) with persons in the service of the state and who may be involved with the evaluation

and or adjudication of this bid? **YES / NO**

3.8.1 If so, furnish particulars.

.....

.....

3.9 Are you, aware of any relationship (family, friend, other) between a bidder and any persons in the service of the state who may be involved with the

evaluation and or adjudication of this bid? **YES / NO**

3.9.1 If so, furnish particulars

3.10 Are any of the company's directors, managers, principal shareholders

or stakeholders in service of the state? **YES / NO**

3.10.1 If so, furnish particulars.

.....

.....

3.11 Are any spouse, child or parent of the company's directors, managers, principal shareholders or stakeholders in service of the state? **YES / NO**

3.11.1 If so, furnish particulars.

.....

.....

CERTIFICATION

I, THE UNDERSIGNED (NAME)…….

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS CORRECT.

I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

Signature ..... Date .....

Position .....

Name of Tenderer .....

H3. DECLARATION FOR PROCUREMENT ABOVE R10 MILLION *MBD5*

DECLARATION FOR PROCUREMENT ABOVE R10 MILLION (ALL APPLICABLE TAXES INCLUDED)

For all procurement expected to exceed R10 million (all applicable taxes included), bidders must complete the following questionnaire:

YES / NO

1 Are you by law required to prepare annual financial statements?

1.1 If yes, submit audited annual financial statements for the past three years or since the date of establishment if established during the past three years.

……

……

YES /NO

2 Do you have any outstanding undisputed commitments for municipal services towards any municipality for more than three months or any other service provider in respect of which payment is overdue for more than 30 days?

2.1 If no, this serves to certify that the bidder has no undisputed commitments for municipal services towards any municipality for more than three months or other service provider in respect of which payment is overdue for more than 30 days.

2.2 If yes, provide particulars.

……

……

……

YES /NO

3 Has any contract been awarded to you by an organ of state during the past five years, including particulars of any material non-compliance or dispute concerning the execution of such contract?

3.1 If yes, provide particulars.

.....

.....

.....

YES / NO

4 Will any portion of goods or services be sourced from outside the Republic, and, if so, what portion and whether any portion of payment from the municipality / municipal entity is expected to be transferred out of the Republic?

4.1 If yes, furnish particulars

.....

.....

CERTIFICATION

I, THE UNDERSIGNED (NAME) .....

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS CORRECT.

I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

.....	.....
Signature	Date
.....	.....
Position	Name of Bidder

I. FORM OF INTENT TO PROVIDE A PERFORMANCE GUARANTEE

[The Tenderer must attach hereto a letter from the bank or institution. with whom he has made the necessary arrangements, to the effect that the said bank or institution will be prepared to provide the required performance guarantee forthwith upon award of the contract to this tenderer].

Tenderers are to refer to Form C1.3: Form of Guarantee.

J. HEALTH AND SAFETY DECLARATION

In terms of Clause 5(h) of the OHSA Construction Regulations 2014 (referred to as "the Regulations" hereafter), a Contractor may only be appointed to perform construction work if the Employer is satisfied that the Contractor has the necessary competencies and resources to carry out the work safely in accordance with the Occupational Health and Safety Act No 85 of 1993 and the Construction Regulations 2014.

To that effect a person duly authorised by the tenderer must complete and sign the declaration hereafter in detail.

Declaration by Tenderer

1. I the undersigned hereby declare and confirm that I am fully conversant with the Occupational Health and Safety Act No 85 of 1993 (as amended by the Occupational Health and Safety Amendment Act No 181 of 1993), and the Construction Regulations 2014.
2. I hereby declare that my company / enterprise has the competence and the necessary resources to safely carry out the construction work under this contract in compliance with the Construction Regulations and the Employer's Health and Safety Specifications.
3. I hereby undertake, if my tender is accepted, to provide a sufficiently documented Health and Safety Plan in accordance with Regulation 7(1) of the Construction Regulations, approved by the Employer or his representative, before I will be allowed to commence with construction work under the contract. I hereby agree that my company/enterprise will not have a claim for compensation for delay or extension of time because of my failure to obtain the necessary approval for the said safety plan.
4. I confirm that copies of my company's approved Health and Safety Plan, the Employer's Safety Specifications as well as the OHSA 1993 Construction Regulations 2014 will be provided on site and will at all times be available for inspection by the Contractor's personnel, the Employer's personnel, the Engineer, visitors, and officials and inspectors of the Department of Labour.
5. I hereby confirm that adequate provision has been made in my tendered rates and prices in the bill of quantities to cover the cost of all resources, actions, training and all health and safety measures envisaged in the OHSA 1993 Construction Regulations 2014, including the cost for specific items that may be scheduled in the bill of quantities.
6. I hereby confirm that I will be liable for any penalties that may be applied by the Employer in terms of the said Regulations for failure on my part to comply with the provisions of the Act and the Regulations as set out in Clause 33 of the Regulations.
7. I agree that my failure to complete and execute this declaration to the satisfaction of the Employer will mean that I am unable to comply with the requirements of the OHSA 1993 Construction Regulations 2014 and accept that my tender will be prejudiced and may be rejected at the discretion of the Employer.
8. I am aware of the fact that, should I be awarded the contract, I must submit the notification required in terms of Clause 4 of the OHSA 1993 Construction Regulations 2014 before I will be allowed to proceed with any work under the contract.

SIGNATURE: ..... DATE: .....

(of person authorised to sign on behalf of the Tenderer)

K1. DECLARATION OF TENDERER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

(MBD 8)

1 This Municipal Tender Document must form part of all bids invited.

2 It serves as a declaration to be used by municipalities and municipal entities in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.

3 The tender of any tenderer may be rejected if that tender, or any of its directors have:

a. abused the municipality's / municipal entity's supply chain management system or committed any improper conduct in relation to such system.

b. been convicted for fraud or corruption during the past five years.

c. wilfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or

d. been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (N° 12 of 2004).

4 **In order to give effect to the above, the following questionnaire must be completed and submitted with the tender.**

Item	Question	Yes	No
4.1	*Is the tenderer or any of its directors listed on the National Treasury's database as a company or person prohibited from doing business with the public sector?* (Companies or persons who are listed on this database were informed in writing of this restriction by the National Treasury after the *audi alteram partem* rule was applied).	Yes ☐	No ☐
4.1.1	If so, furnish particulars:		

4.2	**Is the tenderer or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (N° 12 of 2004)?** (To access this Register enter the National Treasury's website, www.treasury.gov.za, click on the icon "Register for Tender Defaulters" or submit your written request for a hard copy of the Register to facsimile number (012) 3265445).	Yes ☐	No ☐
4.2.1	If so, furnish particulars:		

Item	Question	Yes	No
4.3	Was the tenderer or any of its directors convicted by a court of law (including a court of law outside the Republic of South Africa) for fraud or corruption during the past five years?	Yes ☐	No ☐
4.3.1	If so, furnish particulars:		
4.4	**Does the tenderer or any of its directors owe any municipal rates and taxes or municipal charges to the municipality / municipal entity, or to any other municipality / municipal entity, that is in arrears for more than three months?**	Yes ☐	No ☐

4.4.1	If so, furnish particulars:		
4.5	Was any contract between the tenderer and the municipality / municipal entity or any other organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	Yes ☐	No ☐
4.5.1	If so, furnish particulars:		

CERTIFICATION

I, THE UNDERSIGNED (FULL NAME) ..... CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM TRUE AND CORRECT.

I ACCEPT THAT, IN ADDITION TO CANCELLATION OF A CONTRACT, ACTION MAY BE TAKEN AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

Signature

Date

Position

Name of Tenderer

K2. CERTIFICATE OF INDEPENDENT BID DETERMINATION

MBD9

1 This Municipal Bidding Document (MBD) must form part of all bids[1] invited.

2 Section 4 (1) (b) (iii) of the Competition Act N°. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging).[2] Collusive bidding is a *per se* prohibition meaning that it cannot be justified under any grounds.

3 Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:

a. take all reasonable steps to prevent such abuse.

b. reject the bid of any bidder if that bidder or any of its directors has abused the supply chain management system of the municipality or municipal entity or has committed any improper conduct in relation to such system; and

c. cancel a contract awarded to a person if the person committed any corrupt or fraudulent act during the bidding process or the execution of the contract.

4. This MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.

5. In order to give effect to the above, the attached Certificate of Bid Determination (MBD 9) must be completed and submitted with the bid:

[1] Includes price quotations, advertised competitive bids, limited bids and proposals.

[2] Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.

I, the undersigned, in submitting the accompanying bid:

Tender SCMU005/2025/2026: Upgrade of Command Reservoir & Water Reticulation-Hluhluwe Phase 2

in response to the invitation for the bid made by:

uMkhanyakude District Municipality

do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of: _____that:

(Name of Bidder)

1. I have read and I understand the contents of this Certificate.

2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect.

3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder.

4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder.

5. For the purposes of this Certificate and the accompanying bid, I understand that the word "competitor" shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:

   (a) has been requested to submit a bid in response to this bid invitation.

   (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and

   (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder

6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium[3] will not be construed as collusive bidding.

7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:

   (a) prices.

   (b) geographical area where product or service will be rendered (market allocation)

   (c) methods, factors or formulas used to calculate prices.

   (d) the intention or decision to submit or not to submit, a bid.

   (e) the submission of a bid which does not meet the specifications and conditions of the bid; or

   (f) bidding with the intention not to win the bid.

8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.

9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.

[3] Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.

10. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act N° 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act N° 12 of 2004 or any other applicable legislation.

Signature	Date
Position	Name of Tenderer

L. MUNICIPAL ACCOUNT

MUNICIPAL ACCOUNT/ RATES SETTLEMENT

The Tenderer shall attach one of the following to this page (as applicable):

1. An original/certified copy of the most recent municipal certificate, indicating the status of payment of all municipal accounts and taxes i.e. electricity, water, refuse, rates and levies, from the Municipality in which jurisdiction its business is situated.

2. In the case where the Tenderer does not own property/is a tenant for the purpose of its business establishment, the Tenderer to provide an original/certified copy of a certificate from its landlord certifying that all tenants payments in respect of all municipal accounts and taxes i.e. electricity, water, refuse, rates and levies are paid up to date.

3. In the case where it is not possible for a Tenderer to obtain the certificate in (2) above from its landlord, the Tenderer is required to submit an original/certified copy of the lease agreement for the premises where its business is situated.

(Failure to do so may lead to your Tender being disqualified)

This serve to confirm that my rates with_____ municipality are up to date and have attached my municipal rates account as proof.

NAME OF BIDDER: _____

DATE : _____/_____/____

This serves to confirm that my municipal rates with_____ municipality are not up to date.

I have made arrangement to settle this account by _____ **(ATTACH LETTER OF ARRANGEMENT AS PROOF)**

I intend to settle my account in full within ten (10) working days should I be favoured by uMKHANYAKUDE DISTRICT MUNICIPALITY as a preferred bidder.

NAME OF BIDDER: _____ **Signature:** _____

DATE : ___/____/____

M. QUALITY SCORECARD

Points for quality must be entered here **by the Tenderer** based on the following Quality Scorecard. **Only Tenderers scoring 60% or more for quality will be considered eligible for evaluation**.

Tenderers should supply supporting information to prove points claimed where it's not available in other Returnable Schedules.

1. Criteria: Experience Applicable to last 5 years only: Maximum Score = 15

	List below up to 5 contracts of similar work undertaken as main contractor within the last 5 years Projects listed must be selected from those listed in previous Section G1a and/or G1b of T2.2.1					**Value/Size of Individual Contracts**	**Points**	**Score (S)**
	Contract	**Value**	**Reference**					
			Name	**Organisation**	**Tel N°**			
1.1								
1.2						< R50 million	0	
1.3						R50 – 70 million	1	
1.4						R70 - 90 million	2	
1.5						> R90 million	3	
1.6						**Possible full points**	**15**	
1.7						**ctual Points Obtained S1 =**		

Note: 1. Similar work (or Project) means welded steel pipelines.

2. The Employer will send the "Assessment of Performance" form (see example G3) to two or more of the five references listed here. Two replies will then be used to score Criteria 5a and 5b on Pages T2.55 and T2.56.

2. <u>Criteria</u>: Financial Resources (Bank Rating): Maximum Score = 16

2.	**Score one of the ratings listed below as reflected on rating received – see Section E1 of T2.2.1**	**Points**	**Score (S)**
2.1.	Bank Rating A – Undoubted for the amount of enquiry	16	
2.2	Bank Rating B – Good for the amount of enquiry	12	
2.3	Bank Rating C – Good for the amount quoted if applied strictly in the way of business	9	
2.4	Bank Rating D – Fair trade for the amount of enquiry	5	
2.5	Bank Rating E – Figures considered too high Bank Rating F – Financial Position Unknown Bank Rating G – Dishonour on records Bank Rating H – Frequently Dishonoured	**Not eligible to tender**	
2.6	**Possible Full Points =**	**16**	
	Actual Points Obtained S2 =		

Note: Tenderers are to submit a copy of their bank rating in Section E of T2.2.1

3. Criteria: Experience of Key Personnel: Maximum Score = 17

	Proposed key Personnel	**Experience**		**Points**	**Score (S)**
3.1	Project Director Name:	Relevant Professional Registration with ECSA and/or SACPCMP		2	
		Years of appropriate experience (score one of the categories)	<5 5 to 10 >10	0 1 2	
3.2	Construction Manager Note the Construction Manager may not be the same person as the Project Director Name:	Relevant Professional Registration with ECSA and/or SACPCMP		2	
		Recognised Degree or Diploma in Civil Engineering		2	
		Years of appropriate experience (score one of the categories)	<5 5 to 10 >10	0 1 2	
3.3	Site Supervisor Name:	Recognised Degree or Diploma in Civil Engineering		2	
		Years of appropriate experience (score one of the categories)	<5 5 to 10 >10	0 1 2	
3.4	Total number of full time skilled workers and artisans assigned (in addition to Project Director, Construction Manager and Site Supervisor)	(score one of the categories)	0 1 2 >2	0 1 2 3	
3.5			**Possible Full Points =**	**17**	
3.6			**Actual Points Obtained S3 =**		

Note: Curricula Vitae to be attached in Section T: Key Personnel of T2.2.1.

Years of appropriate experience means experience in the construction of welded steel pipelines, laying of uPVC pipes and Construction of Reservoirs.

Wherever points are claimed certified copies of Registration, Degrees or Diplomas to be attached as applicable. Failure to attach such information will result in nil score being recorded

4. Criteria: Quality Assurance Plan and Control Procedures: Maximum Score = 10

4	Score one status as listed below	**Points**	**Score (S)**
4.1	ISO Accreditation	10	
4.2	Own Internal QA Plan	6	
4.3	None	0	
4.4	**Possible Full Points =**	**10**	
4.5	**Actual Points Obtained S4**		=

Note: If 4.1 selected, attach current copy of ISO Accreditation Certificate.
If 4.2 selected attach copy of company Quality Assurance Plan.

Failure to attach such information will result in nil score being recorded

5. Criteria: Performance on Two Similar Previous Projects undertaken within the last 5 years: Maximum Score = 42

Note: The two projects scored here will be selected and scored by the Employer from the five projects listed in Criteria 1 Experience The Employer will send form G3 to two or more of the five references listed in Criteria 1 on Page T2.55.

The Employer will then complete these two pages and scores based on the reference responses received.

PROJECT 1

TO BE COMPLETED BY EMPLOYER WHEN EVALUATING TENDERS

5a.1 Project Name: _____ Value of work carried out by Contractor: R _____

Detail of work carried out by Contractor: _____

5a.2 Reference: Name:_____ **Organisation**: _____ **Contact Details:**_____

	Qualitative Statements as assessed by Referees (refer to returned forms H3)	**Points**	**Score**
5a.3	"Contractor's Management was adequate for the contract"	Not true 0 Partially fulfilled 1 Substantially fulfilled 2 Completely fulfilled 3 (Score from returned reference sheet H3)	
5a.4	"Contractor provided suitably qualified Site personnel"		
5a.5	"Contractor complied with Health & Safety requirements"		
5a.6	"Contractor's provided adequate resources for the contract"		
5a.7	"Contractor's communication and compliance to instructions was good"		
5a.8	"Quality of work produced was to drawings and specification"		
5a.9	"Contract was completed on time"		
5a.10	**Possible Full Points**	**21**	
5a.11		**Actual Points Obtained S5a =**	

5. <u>Criteria</u>: Performance on Two Similar Previous Projects undertaken within the last 5 years: Maximum Score = 42

Note: The two projects scored here will be selected and scored by the Employer from the five projects listed in Criteria 1 Experience The Employer will send form G3 to two or more of the five references listed in Criteria 1 on Page T2.55.

The Employer will then complete these two pages and scores based on the reference responses received.

PROJECT 2

TO BE COMPLETED BY EMPLOYER WHEN EVALUATING TENDERS

5b.1 Project Name: _____ Value of work carried out by Contractor: R _____

Detail of work carried out by Contractor: _____

5b.2 Reference: Name: _____ Organisation: _____ **Contact Details:**_____

	Qualitative Statements as assessed by Referees (refer to returned forms G3)	**Points**	**Score**
5b.3	"Contractor's Management was adequate for the contract"	Not true 0 Partially fulfilled 1 Substantially fulfilled 2 Completely fulfilled 3 (Score from returned reference sheet H3)	
5b.4	"Contractor provided suitably qualified Site personnel"		
5b.5	"Contractor complied with Health & Safety requirements"		
5b.6	"Contractor's provided adequate resources for the contract"		
5b.7	"Contractor's communication and compliance to instructions was good"		
5b.8	"Quality of work produced was to drawings and specification"		
5b.9	"Contract was completed on time"		
5b.10	**Possible Full Points**	**21**	
5b.11		**Actual Points Obtained S5b =**	

Total Score for Quality

Note: ***Only Eligible for Evaluation if Ta ≥ 60%***

	Criteria	**Possible Full Points**	**Actual Points Obtained**
1	Experience applicable to past 5 years	15	S1=
2	Financial Resources	16	S2=
3	Experience of Key Personnel	17	S3=
4	Quality Assurance Plan and Control Procedures	10	S4=
5	Previous Performance on Similar Projects Project 1 Project 2	 21 21	 S5a= S5b=
6	**Total Possible Points**	**100**	**Total Points Obtained** = % Ta =

MBD 6.1

PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2022

This preference form must form part of all bids invited. It contains general information and serves as a claim form for preference points for specific goals.

NB: BEFORE COMPLETING THIS FORM, BIDDERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF SPECIFIC GOALS, AS PRESCRIBED IN THE PREFERENTIAL PROCUREMENT REGULATIONS, 2022.

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1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to all bids:

- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

1.2 The value of this bid is estimated to exceed R50 000 000 (all applicable taxes included) and therefore the 90/10 preference point system shall be applicable.

1.3 Preference points for this bid shall be awarded for:

(a) Price; and

(b) Specific goals

1.4 The maximum points for this bid are allocated as follows:

	POINTS
PRICE	90
SPECIFIC GOALS OF CONTRIBUTION	10
Total points for Price and Specific Goals must not exceed	**100**

1.5 Failure of a bidder to submit proof of specific goals claimed will be interpreted to mean that preference points for specific goals are not claimed.

1.6 The purchaser reserves the right to require of a bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the purchaser.

2. DEFINITIONS

(a) **"all applicable taxes"** includes value-added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies;

(b) **"bid"** means a written offer in the form determined by an organ of state in response to an invitation to provide goods or services through price quotations, competitive tendering process or any other method envisaged in legislation and "bid" has a corresponding meaning

(c) **"comparative price"** means the price after the factors of a non-firm price and all unconditional discounts that can be utilized have been taken into consideration;

(d) **"consortium or joint venture"** means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract;

(e) **"contract"** means the agreement that results from the acceptance of a bid by an organ of state;

(f) **"EME"** means an Exempted Micro Enterprise as defines by Codes of Good Practice issued in terms of section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(g) **"Firm price"** means the price that is only subject to adjustments in accordance with the actual increase or decrease resulting from the change, imposition, or abolition of customs or excise duty and any other duty, levy, or tax, which, in terms of the law or regulation, is binding on the contractor and demonstrably has an influence on the price of any supplies, or the rendering costs of any service, for the execution of the contract;

(h) **"non-firm prices"** means all prices other than "firm" prices;

(i) **"person"** includes a juristic person;

(j) **"QSE"** means a Qualifying Small Enterprise as defines by Codes of Good Practice issued in terms of section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(k) **"rand value**" means the total estimated value of a contract in Rand, calculated at the time of the tender invitation;

(l) **"Reconstruction and Development Programme"** the Reconstruction and Development Programme as published in Government Gazette No. 16085 dated 23 November 1994;

(m) **"specific goals"** means specific goals as contemplated in section 2(1)(d) of the Act which may include contracting with persons, or categories of persons, historically disadvantaged by unfair discrimination on the basis of race, gender and disability including the

implementation of programmes of the Reconstruction and Development Programme as published in Government Gazette No. 16085 dated 23 November 1994;

(n) **"total revenue"** bears the same meaning assigned to this expression in the Codes of Good Practice;

(o) **"trust"** means the arrangement through which the property of one person is made over or bequeathed to a trustee to administer such property for the benefit of another person; and

(p) **"trustee"** means any person, including the founder of a trust, to whom property is bequeathed in order for such property to be administered for the benefit of another person.

(q) **"Disability"** means, in respect of a person, a permanent impairment of a physical, intellectual, or sensory function, which results in restricted, or lack of, ability to perform an activity in the manner, or within the range, considered normal for a human being.

(r) **"tender for income-generating contracts"** means a written offer in the form determined by an organ of state in response to an invitation for the origination of income-generating contracts through any method envisaged in legislation that will result in a legal agreement between the organ of state and a third party that produces revenue for the organ of state, and includes, but is not limited to, leasing and disposal of assets and concession contracts, excluding direct sales and disposal of assets through public auctions.

(s) .

3. ADJUDICATION USING A POINT SYSTEM

3.1 If two or more tenderers score an equal total number of points, the contract must be awarded to the tenderer that scored the highest points for specific goals.

3.2 Preference points shall be calculated after prices have been brought to a comparative basis taking into account all factors of non-firm prices and all unconditional discounts;

3.3 Points scored must be rounded off to the nearest 2 decimal places.

3.4 In the event that two or more bids have scored equal total points, the successful bid must be the one scoring the highest number of preference points for specific goals.

3.5 If two or more tenderers score equal total points in all respects, the award must be decided by the drawing of lots.

4. POINTS AWARDED FOR PRICE

4.1 THE 80/20 OR 90/10 PREFERENCE POINT SYSTEMS

A maximum of 80 or 90 points is allocated for price on the following basis:

80/20	**or**	**90/10**
$Ps = 80\{1 - \frac{Pt - Pmin}{Pmin}\}$	or	$Ps = 90\{1 - \frac{Pt - Pmir}{Pmin}\}$

Where

Ps	=	Points scored for comparative price of bid under consideration
Pt	=	Comparative price of bid under consideration
Pmin =		Comparative price of lowest acceptable bid

5. POINTS AWARDED FOR LEVEL OF CONTRIBUTION TOWARDS SPECIFIC GOALS

5.1 In terms of s2(b)(i) and (ii) of the Preferential Procurement Regulations Policy Framework Act, a preference points system must be followed for contracts with a Rand value above a prescribed amount a maximum of 10 or 20 points may be allocated for specific goals as contemplated in s2(d) of the Act provided that the lowest acceptable tender scores 90 or 80 points for price, respectively, in accordance with the table below:

Table 1: Specific goals for the tender and points claimed are indicated per the table below.

(Note to organs of state: Where either the 90/10 or 80/20 preference point system is applicable, corresponding points must also be indicated as such.

***Note to tenderers: The tenderer must indicate how they claim points for each preference point system.*)**

80/20 preference point system			
The specific goals allocated points in terms of this tender	**Number of points allocated (10 points) (To be completed by the Municipality**	**Proof required to Claim (10 points) (To be completed by the Municipality)**	**Number of points Claimed (10 points) (To be completed by the tenderer)**
Refer to the table below	10	Fully completed and signed MBD 6.1; and full Central Suppliers Data Base report (CSD) not older than one month	10

PREFERENCE POINT SYSTEM		
PRICE **SPECIFIC GOALS**	**90** **10**	**Requirements to claim points**
Enterprise owned by Black People	2	Certified ID Copies (Directors)/ CSD Report/ Shareholders Certificate
Enterprise owned by Women	2	Certified ID Copies (Directors)/ CSD Report/ Shareholders Certificate
Enterprise owned by Youth	2	Certified ID Copies (Directors)/ CSD Report/ Shareholders Certificate
Enterprise owned by Disabled Persons	2	Medical Certificate
Enterprise owned by SMMEs- QSE and EME	2	CSD report/ Proof of municipal accounts/ affidavit/ proof of residence signed by

		Ward Councillor (for those residing in rural areas/ lease agreement

NB: No points will be claimed by the bidder if it fails to submit proof required to score points for specific goals

90/10 preference point system			
The specific goals allocated points in terms of this tender	**Number of points allocated (10 points) (To be completed by the Municipality)**	**Proof required to Claim (10 points) (To be completed by the Municipality)**	**Number of points Claimed (10 points) (To be completed by the Tenderer)**

5.2 Bidders must submit valid proof for specific goals

5.3 If the municipality is of the view that a tenderer submitted false information regarding a specific goal, will —

a) inform the tenderer accordingly; and

b) give the tenderer an opportunity to make representations within 14 days as to why the tender may not be disqualified or, if the tender has already been awarded to the tenderer, the contract should not be terminated in whole or in part.

5.4 After considering the representations referred to in sub regulation (1)(b), the municipality may, if concludes that such information is false—

(a) disqualify the tenderer or terminate the contract in whole or in part; and

(b) if applicable, claim damages from the tenderer.

6. SPECIFIC GOALS CLAIMED IN TERMS OF PARAGRAPHS 1.4 AND 5.1

Specific goals: = (maximum of 10 or 20 points)

(Points claimed in respect of paragraph 7.1 must be in accordance with the table reflected in paragraph 5.1 and must be substantiated by means of the required proof of specific goals.

7. SUB-CONTRACTING

7.1 Will any portion of the contract be sub-contracted?

(***Tick applicable box***)

YES		NO	**X**

7.1.1 If yes, indicate:

T2.3

5. BID DECLARATION

5.1 Bidders who claim points in respect of specific goals must complete the following:

SPECIFIC GOAL	NUMBER OF POINTS FOR (80/20 PREFERENCE SYSTEM)	NUMBER OF POINTS (90/10 PREFERENCE SYSTEM)
1.Enterprise owned by Black people		
2.Enterprise owned by Women		
3. Enterprise owned by Youth		
4.Enterprise owned by Disabled persons		
5. Enterprise owned by SMME`S –QSE and EME		

6. B-BBEE STATUS LEVEL OF CONTRIBUTOR CLAIMED IN TERMS OF PARAGRAPHS 1.4 AND 3.1

6.1 Specific goals: = ... (maximum of 10 or 20 points)

(Points claimed in respect of paragraph 6.1 must be in accordance with the table reflected in paragraph 3.1 and must be substantiated by submitting the required documents.

7. DECLARATION WITH REGARD TO COMPANY/FIRM

7.1 Name of company/firm :.....

7.2 VAT registration number :.....

7.3 Company registration number:.....

7.4 TYPE OF COMPANY/ FIRM

Partnership/Joint Venture / Consortium

One person business/sole propriety

Close corporation Company

(Pty) Limited

[TICK APPLICABLE BOX]

7.5 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

.....

.....

.....

.....

7.6 COMPANY CLASSIFICATION

☐ Manufacturer

☐ Supplier

☐ Professional service provider

☐ Other service providers e.g. transporter, etc.

[TICK APPLICABLE BOX]

7.7 Total number of years the company/firm has been in business:.....

7.8 I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the specific goals indicated in paragraphs 1.4 and 5.1 of the foregoing certificates, qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:

i) The information furnished is true and correct.

ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form.

iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 5.1, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct.

iv) If the B-BBEE status level of contributor has been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have –

(a) disqualify the person from the bidding process.

(b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct.

(c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation.

(d) recommend that the bidder or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted by the National Treasury from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and

(e) forward the matter for criminal prosecution.

WITNESSES

1. .....

2. .....

.....
SIGNATURE(S) OF BIDDERS(S)

DATE: .....

ADDRESS .....

.....

.....

T2.2.2 RETURNABLE SCHEDULES AND OTHER DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT

O. Record of Addenda to Tender Documents

P.Amendments, Qualifications and Alternatives

Q1.Preliminary Programme

Q2. Preliminary Cash Flow

R. Schedule of Plant and Equipment

S. Proposed Subcontractors

T. Key Personnel

O. RECORD OF ADDENDA TO TENDER DOCUMENTS

I / We confirm that the following communications amending the tender documents that I / we received from the employer or his agent before the closing date for submission of this tender offer have been taken into account in this tender offer.

ADDENDUM No	DATE	TITLE OR DETAILS

SIGNATURE: ..... DATE: .....
(*of person authorized to sign on behalf of the Tenderer)*

P. AMENDMENTS, QUALIFICATIONS AND ALTERNATIVES

(This is not an invitation for amendments, deviations or alternatives but, should the Tenderer desire to make any departures from the provisions of this contract, he shall set out his proposals clearly hereunder. The Employer will not consider any amendment, alternative offers or discounts unless forms (a), (b) and (c) have been completed to the satisfaction of the Employer).

I / We herewith propose the amendments, alternatives and discounts as set out in the tables below:

(a) AMENDMENTS

PAGE, CLAUSE OR ITEM N°	PROPOSED AMENDMENT

[Notes: 1. Proposals for amendments to the General and Special Conditions of Contract will not be considered and may invalidate the offer.

2. The Tenderer must give full details of all the financial implications of the amendments and qualifications in a covering letter attached to his tender.]

(b) ALTERNATIVES

PROPOSED ALTERNATIVE	DESCRIPTION OF ALTERNATIVE

[Notes: 1. Individual alternative items that do not justify an alternative tender, and an alternative offer for time for completion should be listed here.

2. In the case of a major alternative to any part of the work, a separate Bill of Quantities, programme, etc, and a detailed statement setting out the salient features of the proposed alternatives must accompany the tender.

3. Alternative tenders involving technical modifications to the design of the works and methods of construction shall be treated separately from the main tender offer.]

(c) DISCOUNTS

T2.11

ITEM ON WHICH DISCOUNT IS OFFERED	DESCRIPTION OF DISCOUNT OFFERED

[Note: The Tenderer must give full details of the discounts offered in a covering letter attached to his tender, failing which, the offer for a discount may have to be disregarded.]

SIGNATURE: ..... DATE: .....

(of person authorised to sign on behalf of the Tenderer)

Q1. PRELIMINARY PROGRAMME

The Tenderer shall detail below or attach a preliminary programme reflecting the proposed sequence and tempo of execution of the various activities comprising the work for this Contract. The programme shall be in accordance with the information supplied in the Contract, requirements of the Scope of Work and with all other aspects of his Tender.

PROGRAMME

ACTIVITY	**WEEKS**

[Note: The programme must be based on the completion time as specified in the Contract Data. The Tenderer shall attach a form that has enough columns to cover the time periods involved in the period for performance of the contract. No other completion time that may be indicated on this programme will be regarded as an

alternative offer, unless it is listed in Table (b) of Returnable Documents O (previous section), and supported by a detailed statement to that effect, all as specified in the Tender Data]

SIGNATURE: ..... DATE: .....
(of person authorised to sign on behalf of the Tenderer)

T2.13

Q2. PRELIMINARY CASH FLOW

[The Tenderer shall attach a preliminary cash flow reflecting the proposed monthly cash flow in unison with the construction program. The Tenderer shall attach a form that has enough columns to cover the time periods involved in the period for performance of the contract. The program shall be in accordance with the information supplied in the Contract, requirements of the Project Specifications and with all other aspects of this tender.]

Note: The cash flow must be based upon the completion time proposed by the tenderer or as stated elsewhere in this tender document as the case maybe.

Pro Forma Cash Flow

CASHFLOW	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Per Month															
Cumulative															

T2.14

R. SCHEDULE OF PLANT AND EQUIPMENT

The following are lists of major items of relevant equipment that I / we presently own or lease and will have available for this contract if my / our tender is accepted.

(a) Details of major equipment that is owned by me / us and immediately available for this contract.

DESCRIPTION ***(type, size, capacity etc)***	**QUANTITY**	**YEAR OF MANUFACTURE**

Attach additional pages if more space is required

(b) Details of major equipment that will be hired, or acquired for this contract if my / our tender is accepted

DESCRIPTION ***(type, size, capacity etc)***	**QUANTITY**	**HOW ACQUIRED**	
		HIRE/ BUY	**SOURCE**

Attach additional pages if more space is required

The Tenderer undertakes to bring onto site without additional cost to the Employer any additional plant not listed but which may be necessary to complete the contract within the specified contract period.

Failure to complete this form properly and correctly, will lead to the conclusion that the tenderer does not have the necessary plant and equipment resources at his disposal, which will prejudice his tender.

SIGNATURE: ..... DATE: .....

(of person authorised to sign on behalf of the Tenderer)

S. PROPOSED SUBCONTRACTORS

I/We hereby notify you that it is my/our intention to employ the following subcontractors for work in this contract.

If I/we am/are awarded a contract I/we agree that this notification does not change the requirement for me/us to submit the names of proposed subcontractors in accordance with requirements of the contract for such appointments. If there are no such requirements in the contract, then your written acceptance of this list shall be binding between us.

I/We confirm that all subcontractors who are contracted to construct a house or building are registered as home builders with the National Home Builders Registration Council.

NAMES AND ADDRESSES OF PROPOSED SUBCONTRACTORS	COMPANY REGISTRATION No AND CIDB CLASSIFICATION	DESCRIPTION OF WORK TO BE EXECUTED BY SUBCONTRACTOR

[Tenderers are to attach to this page the relative experience of the proposed Sub-Contractors.]

SIGNATURE: ..... DATE:..... ***(of person authorised to sign on behalf of the Tenderer)***

T2.16

T. KEY PERSONNEL

In terms of the Scope of Work and the Conditions of Tender, unskilled workers may only be brought in from outside the local community if such personnel are not available locally.

The Tenderer shall list below the personnel which he intends to utilize on the Works, including key personnel which may have to be brought in from outside if not available locally. Full names must be provided for at least the first three rows.

CATEGORY OF EMPLOYEE	NAMES AND/OR NUMBER OF PERSONS		
	KEY PERSONNEL, PART OF THE CONTRACTOR'S ORGANISATION	KEY PERSONNEL TO BE IMPORTED IF NOT AVAILABLE LOCALLY	UNSKILLED PERSONNEL TO BE RECRUITED FROM LOCAL COMMUNITY
Project Director / Contract Manager			
Construction Manager			
Site Supervisor, Quality Control			
Health & Safety Officer			
Artisans and other Skilled workers			
Plant Operators			
Unskilled Workers			
Others:			

The Tenderer shall attach hereto the *curricula vitae*, in the form included hereafter, of at least the Construction Manager. The information is necessary for evaluation of the tender.

SIGNATURE: ..... DATE: .....

(of person authorised to sign on behalf of the Tenderer)

T2.17

CURRICULUM VITAE OF PROJECT DIRECTOR

Name:	**Date of birth:**
Profession:	**Nationality:**
Qualifications:	**Full time on Project: Y / N**
Professional Registration Number:	**Attend site meetings: Y / N**
Name of Employer (firm):	
Current position:	**Years with firm:**
Employment Record:	
Experience Record Pertinent to Required Service:	

Certification:

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

..... **.....**

SIGNATURE OF THE INCUMBENT IN THE SCHEDULE **DATE**

T2.18

CURRICULUM VITAE OF CONSTRUCTION MANAGER

Name:	**Date of birth:**
Profession:	**Nationality:**
Qualifications:	**Full time on Project: Y / N**
Professional Registration Number:	**Attend site meetings: Y / N**
Name of Employer (firm):	
Current position:	**Years with firm:**
Employment Record:	
Experience Record Pertinent to Required Service:	

Certification:

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

…… **……**

SIGNATURE OF THE INCUMBENT IN THE SCHEDULE **DATE**

CURRICULUM VITAE OF SITE SUPERVISOR

Name:		**Date of birth:**
Profession:		**Nationality:**
Qualifications:		**Full time on Project: Y / N**
Professional Registration No:		**Attend site meetings: Y / N**
Name of Employer (firm):		
Current position:		**Years with firm:**
Employment Record:		
Experience Record Pertinent to Re quired service:		

Certification:

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

..... **.....**

SIGNATURE OF THE INCUMBENT IN THE SCHEDULE **DATE**

CURRICULUM VITAE OF HEALTH AND SAFETY OFFICER

Name:		**Date of birth:**
Profession:		**Nationality:**
Qualifications:		**Full time on Project: Y / N**
Professional Registration No:		**Attend site meetings: Y / N**
Name of Employer (firm):		
Current position:		**Years with firm:**
Employment Record:		
Experience Record Pertinent to Required service:		

Certification:

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

……. **…….**

SIGNATURE OF THE INCUMBENT IN THE SCHEDULE **DATE**

THE CONTRACT

C1: AGREEMENTS AND CONTRACT DATA

C2: PRICING DATA

C3: SCOPE OF WORK

C4: SITE INFORMATION

C1: AGREEMENTS AND CONTRACT DATA

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C1.1: FORM OF OFFER AND ACCEPTANCE

IMPORTANT NOTE:

ALL Tenderers MUST complete and sign Form A: OFFER (the first page hereafter).

Form B: ACCEPTANCE will be signed by the Employer and then only in the case of the successful Tenderer.

Form C: SCHEDULE OF DEVIATIONS must be signed by the Employer as well as the successful Tenderer after award of the contract.

A tender in which Form A: OFFER has not been completed and signed by the Tenderer, will invalidate the OFFER and may be disqualified at the discretion of the Employer.

C1.1 FORM OF OFFER AND ACCEPTANCE

(Agreement)

OFFER

The Employer, identified in the Acceptance signature block, has solicited offers to enter a contract in respect of the following works:

Contract No.SCMU005/2025/2026:Upgrade of Command Reservoir & Water Reticulation-Hluhluwe Phase 2

The Tenderer, identified in the Offer signature block below, has examined the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, and by submitting this Offer has accepted the Conditions of Tender.

By the representative of the Tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance, the Tenderer offers to perform all of the obligations and liabilities of the Contractor under the Contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the Conditions of Contract identified in the Contract Data.

THE OFFERED TOTAL OF THE PRICES INCLUSIVE OF VALUE ADDED TAX IS

.....

.....Rand (in words); R ..... (in figures).

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document to the Tenderer before the end of the period of validity stated in the Tender Data, whereupon the Tenderer becomes the party named as the Contractor in the Conditions of Contract identified in the Contract Data.

For the Tenderer:

.....

Signature

.....

Name

.....

Capacity

Name and address of *organisation*):

.....

.....

.....

Signature and name of witness:

.....

Signature

.....

Name

.....

Date

ACCEPTANCE

By signing this part of the Form of Offer and Acceptance, the Employer identified below accepts the

Tenderer's Offer. In consideration thereof, the Employer shall pay the Contractor the amount due in accordance with the Conditions of Contract identified in the Contract Data. Acceptance of the Tenderer's Offer shall form an agreement between the Employer and the Tenderer upon the terms and conditions contained in this Agreement and in the Contract that is the subject of this Agreement.

The terms of the contract are contained in

Part 1 Agreement, and Contract Data, (which include this Agreement)

Part 2 Pricing Data

Part 3 Scope of Work

Part 4 Site Information

and drawings and documents or parts thereof, which may be incorporated by reference into Parts 1 to 4 above.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules as well as any changes to the terms of the Offer agreed by the Tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and

forming part of this Agreement. No amendments to or deviations from said documents are valid unless contained in this Schedule, which must be duly signed by the authorised representative(s) of both parties.

The Tenderer shall within two weeks after receiving a completed copy of this Agreement, including the

Schedule of Deviations (if any), contact the Employer's Agent (whose details are given in the Contract Data) to arrange the delivery of any other bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the Conditions of Contract identified in the Contract Data at, or just after, the date this Agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this Agreement.

Notwithstanding anything contained herein, this Agreement comes into effect on the date when the

Tenderer receives one fully completed original copy of this document, including the Schedule of Deviations

(if any). Unless the Tenderer (now Contractor) within five days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this Agreement, this Agreement shall constitute a binding contract between the parties.

For the Employer:

.....

Signature

.....

Name

.....

Capacity

Name and address of organisation:

.....

.....

.....

Signature and name of witness:

.....

Signature

.....

Name

.....

Date

SCHEDULE OF DEVIATIONS

Notes:

1. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender,
2. A Tenderer's covering shall not be included in the final contract document. Should any matter in such, letter, which constitutes a deviation as aforesaid become the subject of agreements reached during the process of, offer and acceptance, the outcome of such agreement shall be recorded here,
3. Any other matter arising from the process of offer and acceptance either as a confirmation, clarification or change to the tender documents and which it is agreed by the Parties becomes an obligation of the contract shall also be recorded here,
4. Any change or addition to the tender documents arising from the above agreements and recorded here, shall also be incorporated into the final draft of the Contract,

1. Subject: .....

Details: .....

.....

2. Subject: .....

Details: .....

.....

By the duly authorised representatives signing this Schedule of Deviations, the Employer and the Tenderer agree to and accept the foregoing Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, as well as any confirmation, clarification or change to the terms of the offer agreed by the Tenderer and the Employer during this process of offer and acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the Tenderer of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this Agreement.

For the Tenderer:	**For the Employer**
Signature.....	Signature .....
Name	Name .....
Capacity	Capacity .....

Name and address of organisation	Name and address of organisation
.....	.....
.....	.....
.....	.....
Witness Signature.....	Witness Signature. .....
Witness Name.....	Witness Name .....
Date.....	Date .....

C1.2 CONFIRMATION OF RECEIPT

The Tenderer, (now Contractor), identified in the Offer part of this Agreement hereby confirms receipt from the Employer, identified in the Acceptance part of this Agreement, of one fully completed original copy of this Agreement, including the Schedule of Deviations (if any) today:

The ..... (day) of ..... (month) 20..... (year)

at .....

(place)

For the Contractor:

.....

Signature

.....

Name

.....

Capacity

Signature and name of witness:

.....

Signature

.....

Name

.....

Date

C1.3: CONTRACT DATA

C1.3: CONTRACT DATA

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C.1.3 CONTRACT DATA

C1.3.1 PART 1: DATA PROVIDED BY THE EMPLOYER

CONDITIONS OF CONTRACT

The Conditions of Contract are

- the "General Conditions of Contract" **o** "The General Conditions of Contract for Construction Works, Third Edition, 2015" published by the South African Institution of Civil Engineering, Private Bag X200, Halfway House, 1685 and obtainable from www.saice.org.za; together with
    - o each subsequent corrigendum and erratum thereto, as issued by their publisher up to the Base Date of this Contract;

    (collectively hereinafter referred to as GCC 2015); and

- amendments to the GCC 2015 as contained in this Contract Data.

Each party to the Contract shall purchase its own copy of the correct print edition of the GCC 2015 that applies to this Contract (see Note 1 below), available from the publisher:

South African Institution of Civil Engineering
Private Bag X200
Halfway House 1685
South Africa
Tel +27 (0)11 805 5947

www.saice.org.za

NOTES:

Note 1

GCC 2015 makes several references to the Contract Data. The Contract Data shall take precedence over the GCC 2015 in the interpretation of any ambiguity or inconsistency.

Note 2

Each item of data below is cross-referenced to the Clause in the GCC 2015 to which it applies.

Note 3

The documents forming the Contract are to be taken as mutually explanatory of one another.

Note 4

Certain pro-forma forms and pro-forma agreements contained in the GCC 2015 have been adapted for this particular Contract. Those pro-forma forms and pro-forma agreements contained in the GCC 2015 do not apply where replaced by similar pro-forma forms and pro-forma agreements in this procurement document.

Note 5 The term 'Employer's Agent' in this tender has the same meaning as 'Engineer' as used in earlier versions of GCC and still in customary use in the construction industry and shall be understood in this sense.

CONTRACT-SPECIFIC DATA

Each item of data given below is cross-referenced to the clause in the Conditions of Contract to which it applies.

The following contract-specific data, referring to the General Conditions of Contract, are applicable to this Contract:

Compulsory Data:

Clause	Data
1.1.1.13	The Defects Liability Period is 365 days
1.1.1.14	Time for Practical Completion is 1**8** months
1.1.1.15	The name of the Employer is uMkhanyakude District Municipality
1.1.1.26	The Pricing Strategy of a Re-measurement Contract shall apply
1.1.1.27	The conditions of contract **GCC (SAICE)** = **General Conditions of Contract for Construction Works**, published by the **South African Institution of Civil Engineering (SAICE)** — most commonly the **GCC 2015 (3rd Edition)**.
1.2.1.2	The address of the Employer is: Physical address: Stand 13433 Kingfisher Road MKUZE 3965 Postal address: Private Bag 449 MKUZE 3965

	Contact Person : Mr Sbusiso Hlatshwayo Email : hlatshwayo.ukdm@gmail.com Contact numbers: Tel. : (035) 573 8600 Fax : (035) 573 8730
1.1.1.16	The name of the Employer's Agent is: Zimile PTY) Ltd

Clause	**Data**
1.2.1.2	The address of the Employer's Agent is: Physical address: 1 George Macfarlane Ln Townhill, Pietermaritzburg 3201 Contact Person : Mr Nhlanhla Gumede e-mail address : Nhlanhlag@zimile.co.za Contact numbers: Corporate: 039 940 6729 Cell : 067 223 7415
3.2.3	The Employer's Agent shall obtain the specific approval of the Employer before carrying out any of his functions or duties according to the following Clauses of the General Conditions of Contract.

4.10.1	The contractor shall employ a Community Liaison Officer (CLO), who will be identified by the Employer and on terms specified in this document. The contractor shall recruit local labour only through the services of the CLO in consultation with the Project Steering Committee. **Contractor's default in Payment to Labourers and Employees:** Any dispute between the Contractor and labourers, regarding delayed payment or default in payment of fair wages, if not resolved immediately may compel the Employer to intervene. The Employer may, upon the Contractor defaulting payment, pay the moneys due to the workers not honoured in time, out of any moneys due or which may become due to the Contractor under the Contract.
5.3.1	The documentation required before commencement with Works execution are: • Health and Safety Plan (Refer to Clause 4.3) • Initial programme (Refer to Clause 5.6) • Performance Security (Refer to Clause 6.2) • Insurance (Refer to Clause 8.6) • Cv's and Qualifications of proposed project team (The proposed team shall be equal to or better than the resources presented during the tender) • Organogram/Structure of proposed project team • Cashflow Projections
5.3.2	The time to submit the documentation required before commencement with Works execution is 14 days
5.4.2	The access and possession of Site shall not be exclusive to the Contractor but shall be as set out elsewhere in the Contract.

Clause	**Data**
5.8.1	The non-working days are Sundays The special non-working Days are: • Any statutory public holiday in terms of the Public Holidays Act, and, where such statutory public holiday falls on a Sunday, and the next Monday subsequently becomes a statutory public holiday in terms of the Public Holidays Act, then both the relevant Sunday and the relevant Monday shall be special non-working days under the contract. • any proclaimed statutory day of mourning which is proclaimed as a statutory public holiday. • any proclaimed statutory election day which is proclaimed as a statutory public holiday and • all annual year-end shutdown periods as recommended by the South African Bargaining Council for the Civil Engineering Industry.

5.12.2.2	Extension of Time for Abnormal Rainfall Extensions of time to be considered for abnormal rainfall in terms of Clause 5.12.2.2 shall be calculated as per section C4.2. For the purpose of applying the formula, accurate rain gauging shall be taken at suitable points on the Site and the Contractor shall at his own expense, take all necessary precautions to ensure that rain gauges cannot be interfered with by unauthorized persons.
5.13.1	The penalty for failing to complete the works is 0,05% of contract price per day. The limit of penalties is 10% of the Contract Price
5.16.3	The latent defect period is 10 years, commencing on the day after the date of certification of Practical Completion
6.2.1	The security to be provided by the Contractor shall be a total not exceeding 10% of the Contract Sum in a form to be selected by the Contractor from the applicable options in C1.2.2.
6.5.1.2.3	The percentage allowance to cover overhead charges is: 50% on the cost of labour (6.5.1.2.1) and 15% on the cost of materials (6.5.1.2.2).
6.8.2	The value of the certificates issued shall be adjusted in accordance with the Contract Price Adjustment Schedule with the following values: The value of the Contract Price Adjustment Factor shall be calculated to 4 decimal places. The value of "x" is 0,10. The values of the coefficients are: a = 0,25 b = 0,25 c = 0,40 d = 0,10 The Site or largest part thereof shall be deemed to be located in the national province of KwaZulu-Natal.

Clause	Data
	The descriptions of the "L", "P", "M" and "F" indices in the Contract Price Adjustment Schedule shall be replaced with the following, which shall apply to this contract: "L" is the "Labour Index" and shall be the Consumer Price Index for the urban area nearest to the Site, as stated in the Contract Data, and as published in the Statistical News Release, P0141, Additional Tables: Table 14 "CPI – all items according to area" of Statistics South Africa, or as otherwise amended after the Commencement Date by Statistics South Africa to another suitable equivalent index to be applied to the contract and which takes effect on a specific date, subject to written agreement between the Contractor and Employer. P" is the "Construction Equipment Index" and shall be the Producer Price Index applicable to the appropriate Construction Equipment as stated in the Contract Data and as published in the Statistical Release P0151, Table 4 of Statistics South Africa, or as otherwise amended after the Commencement Date by Statistics South Africa to another suitable equivalent index to be applied to the contract and which takes effect on a specific date, subject to written agreement between the Contractor and Employer. The Construction Equipment shall be Civil engineering plant as listed in Statistical Release P0151, Table 4 "Producer Price Index" of Statistics South Africa. "M" is the "Materials Index" and shall be the Producer Price Index applicable to the appropriate materials as stated in the Contract Data and as published in the Statistical Release P0151, Table 3 or Table 4 of Statistics South Africa, or as otherwise amended after the Commencement Date by Statistics South Africa to another suitable equivalent index to be applied to the contract and which takes effect on a specific date, subject to written agreement between the Contractor and Employer. The Materials shall be Building and Construction - Civil Engineering as listed in the Statistical Release P0151, Table 3 or Table 4 respectively, of Statistics South Africa (which shall apply to the "Materials Index" as a relevant Producer Price Index). "F" is the "Fuel Index" and shall be the Producer Price Index for Diesel at wholesale level for the area as stated in the Contract Data and as published in the Statistical News Release P0151, Table 4 of Statistics South Africa, or as otherwise amended after the Commencement Date by Statistics South Africa to another suitable equivalent index to be applied to the contract and which takes effect on a specific date, subject to written agreement between the Contractor and Employer.' Where applicable, the area for Diesel at wholesale level shall be 'Coast' as listed in the Statistical Release P0151, Table 4 of Statistics South Africa (which shall apply to the "Fuel Index" as a relevant Producer Price Index). The applicable industry for the Producer Price Index for materials is Building and Construction Civil Engineering. The area for the Producer Price Index for fuel is Coast. The base month is "one month prior to the Closing Time of the Tender".

6.8.3	Price adjustments for variations in the costs of special materials are not provided for.
6.10.1.5	The percentage advance on materials not yet built into the Permanent Works is 80%. Proof of ownership is required.
6.10.3	There is no limit of retention money.
Clause	**Data**
8.6.1.1.2	The value of Plant and materials supplied by the Employer to be included in the insurance sum is: Nil.
8.6.1.1.3	The amount to cover professional fees for repairing damage and loss to be included in the insurance sum is a maximum of 4 % of the Contract Sum.
8.6.1.3	The limit of indemnity for liability insurance is R 10 000 000,00 for any single claim. The number of claims during the construction and Defects Liability Periods shall be unlimited.
8.6.8	**Manufacturing and/or fabrication and storage at premises other than the Site** *Add the following new Sub-Clause 8.6.8:* "Where the contract involves manufacturing and/or fabrication of the Works or part thereof at premises other than the Site, the Contractor shall satisfy the Employer that all materials and equipment for incorporation in the Works are adequately insured during manufacture and/or fabrication. In the event of the Employer having an insurable interest in such Works during manufacture or fabrication then such interest shall be noted by endorsement to the Contractor's policies of insurance."
10.5.2	Dispute resolution shall be by ad-hoc adjudication
10.5.3	The number of Adjudication Board Members to be appointed is one.
10.7.1	The determination of disputes shall be by arbitration.

Variations to the General Conditions of Contract applicable to this contract are:

Clause	Data
	None

Additional clauses to the General Conditions of Contract applicable to this contract are:

Clause	Data

1.1 1.1.1.35	**Definition** *Add the following at the end of Sub-Clause 1.1.1:* "Client", as used in the Occupational Health and Safety Act - Construction Regulations, means Employer.
1.1.1.36	"Principal Contractor", as used in the Occupational Health and Safety Act - Construction Regulations, means Contractor.

C1.3.2 PART 2: DATA PROVIDED BY THE CONTRACTOR

The Contractor is advised to read the *General Conditions of Contract*, as specified in Part 1, in order to understand the implications of this Data which is required to be completed.

Each item of data given below is cross-referenced to the clause in the Conditions of Contract to which it mainly applies

Clause	**Data**
1.1.1.9	The Name of the Contractor is _____ *[Enter the legal name of the Contractor]*

<table>
<tr><td>1.2.1.2</td><td>The address of the Contractor is:

Physical address:

_____
_____
_____
_____

Postal address:

_____
_____
_____
_____

e-mail address: _____

Contact numbers:

Corporate: _____
Direct: _____
Mobile: _____
Fax: _____</td></tr>
<tr><td>6.2.1</td><td>The security to be provided by the Contractor shall be one of the following:

<table><tr><th>Type of security

(with Value Added Tax excluded from the Contract Sum and from the value of the Works for calculating the percentages)</th><th>Indicate

"Yes" or

"No"</th></tr><tr><td>Retention of 10% of the value of the Works (5% held for defects liability period).</td><td></td></tr><tr><td>Fixed Performance guarantee of 10% of the Contract Sum</td><td></td></tr><tr><td>Variable Performance guarantee</td><td></td></tr></table></td></tr>
</table>

Signature..... Date.....

(of person authorised to sign on behalf of the Tenderer)

C1.3.3 Part 3: Corrigenda to GCC 2015 by SAICE

Corrections 2017-06-09 published by SAICE and all further updates, errata or other amendments to GCC 2015 published by SAICE prior to the Base Month of this Contract shall be deemed to form part of GCC 2015.

Each party to the Contract shall purchase its own copy of such updates, errata, corrections and other amendments to GCC 2015.

C1.3.4 Part 4: Corrigenda to GCC 2015 by the Employer

The items in this Part 4 (if any) shall be deemed to be supplementary corrigenda by the Employer to the GCC 2015 and shall be deemed to form part of GCC 2015. In the event of conflict between any item in this Part 4 and an item in the above Part 3, the relevant item in Part 3 shall take precedence.

C1.4: PERFORMANCE GUARANTEE

C1.4 PERFORMANCE GUARANTEE

For use with the General Conditions of Contract for Construction Works, Third Edition, 2015.

GUARANTOR DETAILS AND DEFINITIONS

"Guarantor" means: .....

Physical address: .....

"Employer" means: uMkhanyakude District Municipality

"Company" means:.....

"Contractor" means: .....

"Employer's Agent" means: Zimile Consulting Engineers

"Works" means: Contract SCMU005/2025/20260 Upgrade of Command Reservoir & Water Reticulation-Hluhluwe Phase 2

"Site" means: Construction area at Mfekayi North and South.

"Contract" means: The Agreement made in terms of the Form of Offer and Acceptance and such amendments or additions to the Contract as may be agreed in writing between the parties.

"Contract Sum" means: The accepted amount inclusive of tax of R .....

Amount in words: .....

.....

"Guaranteed Sum" means: The maximum aggregate amount of R .....

Amount in words: .....
.....
Type of Performance Guarantee: ..... *(Insert Variable or Fixed)*

"Expiry Date" means: ..... (*Give date)* or any other later date set

by the Contractor and / or Employer provided such instruction is received prior to the Expiry Date as indicated here.

CONTRACT DETAILS

Employer's Agent issues: Interim Payment Certificates, Final Payment Certificate and the Certificate of Completion of the Works as defined in the Contract.

1. VARIABLE PERFORMANCE GUARANTEE

1.1 Where a Variable Performance Guarantee has been selected, the Guarantor's Liability shall be limited during the following periods to diminishing amounts of the Guaranteed Sum as follows:

1.1.1 From and including the date of signing the Performance Guarantee up to and including the date of the interim payment certificate certifying, for the first time, more than 50% of the Contract Sum:

R.....

(Amount in words .....)

1.1.2 From the day following the date of the said interim payment certificate up to and including the Expiry Date, or the date of issue by the Employer's Agent of the Certificate of Completion of the Works, whichever occurs first:

R.....

(Amount in words .....)

1.2 The Employer's Agent and/or the Employer shall advise the Guarantor in writing of the date on which the interim payment certificate certifying, for the first time, more than 50% of the Contract Sum, has been issued and the date on which the Certificate of Completion of the Works has been issued.

2. FIXED PERFORMANCE GUARANTEE

2.1 Where a Fixed Performance Guarantee has been selected, the Guarantor's liability shall be limited to the amount of the Guaranteed Sum.

2.2 The Guarantor's period of liability shall be from and including the date on which the Performance Guarantee is signed, up to and including the Expiry Date, or the date of issue by the Employer's Agent of the Certificate of Completion of the Works, or the date of payment in full of the Guaranteed Sum, whichever occurs first.

2.3 The Employer's Agent and/or the Employer shall advise the Guarantor in writing of the date on which the Certificate of Completion of the Works has been issued.

3. CONDITIONS APPLICABLE TO VARIABLE AND FIXED PERFORMANCE GUARANTEES

3.1 The Guarantor hereby acknowledges that:

3.1.1 Any reference in this Performance Guarantee to the Contract is made for the purpose of convenience and shall not be construed as any intention whatsoever to create an accessory obligation or any intention whatsoever to create a suretyship.

3.1.2 Its obligation under this Performance Guarantee is restricted to the payment of money.

3.2 Subject to the Guarantor's maximum liability referred to in 1.1 or 2.1, the Guarantor hereby undertakes to pay the Employer the sum certified upon receipt of the documents identified in 3.2.1 to 3.2.3:

3.2.1 A copy of a first written demand issued by the Employer to the Contractor stating that payment of a sum certified by the Employer's Agent in an Interim or Final Payment Certificate has not been made in terms of the Contract and failing such payment within seven (7) calendar days, the Employer intends to call upon the Guarantor to make payment in terms of 3.2.2.

3.2.2 A first written demand issued by the Employer to the Guarantor at the Guarantor's physical address with a copy to the Contractor stating that a period of seven (7) days has elapsed since the first written demand in terms of 3.2.1 and the sum certified has still not been paid.

3.2.3 A copy of the aforesaid payment certificate which entitles the Employer to receive payment in terms of the Contract of the sum certified in 3.2.

3.3 Subject to the Guarantor's maximum liability referred to in 1.1 or 2.1, the Guarantor undertakes to pay to the Employer the Guaranteed Sum or the full outstanding balance upon receipt of a first written demand from the Employer to the Guarantor at the Guarantor's physical address calling up this Performance Guarantee, such demand stating that:

3.3.1 the Contract has been terminated due to the Contractor's default and that this Performance Guarantee is called up in terms of 3.3; or

3.3.2 a provisional or final sequestration or liquidation court order has been granted against the Contractor and that the Performance Guarantee is called up in terms of 3.3; and

3.3.3 the aforesaid written demand is accompanied by a copy of the notice of termination and/or the provisional/final sequestration and/or the provisional liquidation court order.

3.4 It is recorded that the aggregate amount of payments required to be made by the Guarantor in terms of 3.2 and 3.3 shall not exceed the Guarantor's maximum liability in terms of 1.1 or 2.1.

3.5 Where the Guarantor has made payment in terms of 3.3, the Employer shall upon the date of issue of the Final Payment Certificate submit an expense account to the Guarantor showing how all monies received in terms of this Performance Guarantee have been expended and shall refund the Guarantor any resulting surplus. All monies refunded to the Guarantor in terms of this Performance Guarantee shall bear interest at the prime overdraft rate of the Employer's bank compounded monthly and calculated from the date payment was made by the Guarantor to the Employer until the date of refund.

3.6 Payment by the Guarantor in terms of 3.2 or 3.3 shall be made within seven (7) calendar days upon receipt of the first written demand to the Guarantor.

3.7 Payment by the Guarantor in terms of 3.3 will only be made against the return of the original Performance Guarantee by the Employer.

3.8 The Employer shall have the absolute right to arrange his affairs with the Contractor in any manner which the Employer may deem fit and the Guarantor shall not have the right to claim his release from this Performance Guarantee on account of any conduct alleged to be prejudicial to the Guarantor.

3.9 The Guarantor chooses the physical address as stated above for the service of all notices for all purposes in connection herewith.

3.10 This Performance Guarantee is neither negotiable nor transferable and shall expire in terms of 1.1.2 or 2.2, where after no claims will be considered by the Guarantor. The original of this Guarantee shall be returned to the Guarantor after it has expired.

3.11 This Performance Guarantee, with the required demand notices in terms of 3.2 or 3.3, shall be regarded as a liquid document for the purposes of obtaining a court order.

3.12 Where this Performance Guarantee is issued in the Republic of South Africa the Guarantor hereby consents in terms of Section 45 of the Magistrate's Courts Act No 32 of 1944, as amended, to the jurisdiction of the Magistrate's Court of any district having jurisdiction in terms of Section 28 of the said Act, notwithstanding that the amount of the claim may exceed the jurisdiction of Magistrate's Court.

Signed at .....

Date .....

Guarantor's signatory (1) .....

Capacity .....

Guarantor's signatory (2) .....

Capacity .....

Witness signatory (1) .....

Witness signatory (2) .....

C1.5: AGREEMENT IN TERMS OF SECTION 37(2) OF THE OCCUPATIONAL HEALTH AND SAFETY ACT No 85 OF 1993

THIS AGREEMENT is made between **uMkhanyakude District Municipality** (hereinafter called the EMPLOYER) of the one part, herein represented by: ..... in

his capacity as: .....

AND: .....

(hereinafter called the CONTRACTOR) of the other part, herein represented by .....

..... in

his capacity as: .....

duly authorized to sign on behalf of the Contractor.

WHEREAS the CONTRACTOR is the Mandatory of the EMPLOYER in consequence of an agreement between the CONTRACTOR and the EMPLOYER in respect of

Contract Tender SCMU005/2025/2026; Upgrade of Command Reservoir & Water Reticulation-Hluhluwe Phase 2

AND WHEREAS the EMPLOYER and the CONTRACTOR have agreed to enter into an agreement in terms of the provisions of Section 37(2) of the Occupational Health and Safety Act No 85 of 1993, as amended by OHSA Amendment Act No 181/1993 (hereinafter referred to as the ACT).

NOW THEREFORE the parties agree as follows:

1. The CONTRACTOR undertakes to acquaint the appropriate officials and employees of the CONTRACTOR with all relevant provisions of the ACT and the regulations promulgated in terms thereof.
2. The CONTRACTOR undertakes to fully comply with all relevant duties, obligations and prohibitions imposed in terms of the ACT and Regulations: Provided that should the EMPLOYER have prescribed certain arrangements and procedures that same shall be observed and adhered to by the CONTRACTOR, his officials and employees. The CONTRACTOR shall bear the onus of acquainting himself/herself/itself with such arrangements and procedures.
3. The CONTRACTOR hereby accepts sole liability for such due compliance with the relevant duties, obligations, prohibitions, arrangements and procedures, if any, imposed by the ACT and Regulations, and the CONTRACTOR expressly absolves the EMPLOYER and the EMPLOYER'S AGENT from being obliged to comply with any of the aforesaid duties, obligations, prohibitions, arrangements and procedures in respect of the work included in the contract.

4. The CONTRACTOR agrees that any duly authorized officials of the EMPLOYER shall be entitled, although not obliged, to take such steps as may be necessary to ensure that the CONTRACTOR has complied with his undertakings as more fully set out in paragraphs 1 and 2 above, which steps may include, but shall not be limited to, the right to inspect any appropriate site or premises occupied by the CONTRACTOR, or to take such steps it may deem necessary to remedy the default of the CONTRACTOR at the cost of the CONTRACTOR

5. The CONTRACTOR shall be obliged to report forthwith to the EMPLOYER any investigation, complaint or criminal charge which may arise as a consequence of the provisions of the ACT and Regulations, pursuant to work performed in terms of this agreement, and shall, on written demand, provide full details in writing of such investigation, complaint or criminal charge.

Thus, signed at ..... for and on behalf of the **CONTRACTOR**

on this the ..... day of ..... 20.....

SIGNATURE: .....

NAME AND SURNAME: .....

CAPACITY: .....

WITNESSES: 1. .....

2. .....

Thus, signed at ..... for and on behalf of the **EMPLOYER**

on this the ..... day of ..... 20.....

SIGNATURE: .....

NAME AND SURNAME: .....

CAPACITY: .....

WITNESSES: 1. .....

2. .....

C1.6: TRANSFER OF RIGHTS AND INDEMNITY

C1.6: TRANSFER OF RIGHTS AND INDEMNITY

(To be completed during construction by successful Tenderer only when claiming for materials on site)

Claim for materials on site, Payment Certificate No. ..... **Date:** .....

Contract No: SCMU005/2025/2026 Upgrade of Command Reservoir and Water Reticulation-Hluhluwe phase 2

I, the undersigned (name of signatory) ..... in my capacity as..... ..... of (name of Contractor)

.....

duly authorised hereto on behalf of the Contractor hereby transfer, cede and assign all the Contractor's rights, title and interest in and to the materials and goods, for which evidence of bona fide ownership is attached hereto, unto and in favour of (name of Employer) ..... Insofar as the

Contractor retains actual control of the materials and goods, the right of ownership thereof passes to the Employer by *constitutum possessorium*.

I herewith indemnify the Employer against any claim to and in respect of said materials by reason of the Contractor's sequestration or liquidation or of any defect in the Contractor's title to the materials and agree that no payment for materials on site will be made by the Employer until such time as I have submitted documentary proof of bona fide ownership of the said materials and goods.

This transfer shall become effective upon conclusion of the Contractor receiving payment from the Employer or from any other person on behalf of the Employer for the materials and goods as Materials on Site, payment of retention money thereon excluded.

I further confirm that I am fully responsible for all materials and goods listed under this Transfer of Rights and that they have been insured adequately against all risks and will remain insured until they are built into or used in the permanent works and taken over by the Employer.

This certificate of Transfer of Rights applies only to the materials and goods as listed in the following table.

DESCRIPTION OF ITEM	UNIT	QUANTITY	RATE	AMOUNT	SUPPLIER
TOTAL VALUE OF MATERIALS AND GOODS					

Signed by: .....Date:..... for and on behalf of the Contractor.

Witnessed by: ..... Date: .....

NOTE: This form, together with the documentary proof of ownership or proof of payment by the Contractor to the supplier, shall accompany the Contractor's claim for payment for materials on site in terms of

Clause 6.10.1.5 of the General Conditions of Contract 2015.

C1.7: ADJUDICATOR'S CERTIFICATES

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C1.7.2:	Adjudication Board Member Agreement	C1.35

C1.7.1 DISCLOSURE STATEMENT

Please note that words in italics within brackets are items which should be stated.

(Date)

Contract: .....

Contractor: .....

Employer: uMkhanyakude District Municipality

Employer's Agent: .....

Dear Sirs/Mesdames

I am willing and available to serve as *ad-hoc* Adjudication Board Member in the above-mentioned Contract.

In accordance with the General Conditions of Contract for Construction Works Adjudication Board Rules relating to disclosure statements by selected or nominated persons to the adjudication, I hereby state that:

- I shall act with complete impartiality and know of nothing at this time, which could affect my impartiality.
- I have had no previous involvement with this project.
- I do not have any financial interest in this project.
- I am not currently employed by the Contractor, Employer or Employer's Agent.
- I do not have any financial connections with the Contractor, Employer or Employer's Agent.
- I do not have or have not had a personal relationship with any authoritative member of the Contractor, Employer or the Employer's Agent which could affect my impartiality.
- I undertake to immediately disclose to the parties any changes in the above position which could affect my impartiality or be perceived to affect same.

Should there be any deviation from the foregoing statements, details shall be given.

I further declare that I am experienced in the work which is carried out under the Contract and in interpreting contract documentation.

Name in full: .....

Signature: .....

C1.7.2: ADJUDICATION BOARD MEMBER AGREEMENT

This Agreement is entered into between:

Adjudication Board Member:

Name: .....

Physical address: .....

.....

.....

Postal address: .....

.....

.....

e-mail address: ..... Fax number: .....

Telephone number: ..... Mobile number: .....

Contractor:

Name: .....

Physical address: .....

.....

.....

Postal address: .....

.....

.....

e-mail address: ..... Fax number: .....

Telephone number: ..... Mobile number: .....

Employer:

Name: uMkhanyakude District Municipality

Physical address: Stand 13433, Kingfisher Road, MKUZE, 3965

Postal address: Private Bag 449, MKUZE, 3965

Telephone number: (035) 573 8600 Fax number: (035) 573 8730

The Contractor and the Employer will hereinafter be collectively referred to as the Parties.

The Parties entered into a Contract for Contract .....

....

which provides that a dispute under or in connection with the General Conditions of Contract for Construction Works, Third Edition, 2015, must be referred to ad-hoc adjudication.

The undersigned natural person has been appointed to serve as Adjudication Board Member and together with the undersigned Parties agree as follows:

1, The Adjudication Board Member accepts to perform his duties in accordance with the terms of Contract, the General Conditions of Contract for Construction Works Adjudication Board Rules and this Agreement.

2. The Adjudicator undertakes to remain independent and impartial of the Contractor, Employer and Employer's Agent for the duration of the Adjudication Board proceedings.

3. The Adjudication Board Member agrees to serve for the duration of the Adjudication Board proceedings.

4. The Parties may at any time, without cause and with immediate effect, jointly terminate this Agreement.

5. Unless the Parties agree, the Adjudication Board Member shall not act as arbitrator or representative of either Party in any subsequent proceedings between the Parties under the Contract. No Party may call the Adjudication Board Member as a witness in any such subsequent proceedings.

6. The standing Adjudication Board's duties shall end upon the Adjudication Board Member(s) receiving notice from the Parties of their joint decision to disband the Adjudication Board.

7. The Adjudication Board Member shall be paid in respect of time spent upon or in connection with the adjudication including time spent travelling:

(a) A monthly retainer of ..... *(amount)* for ..... *(number)* of months, and/or

(b) A daily fee of ..... *(amount)* based on a ..... .*(number)* hour day, and or

(c) An hourly fee of ..... *(amount)*, and/or

(d) A non-recurrent appointment fee of ..... *(amount)* which shall be accounted for in the final sums payable.

8. The Adjudication Board Member's expenses incurred in adjudication work shall be reimbursed at cost.

Upon submission of an invoice for fees and expenses to the Parties, the *(Contractor/Employer*)* shall pay the full amount within 28 days of receipt of the invoice and he shall be reimbursed by the other party by half the amount so that the fees and expenses are borne equally by the Parties. Late payment of such invoices shall attract interest at prime plus 3% points compounded monthly at the prime rate charged by the Adjudication Board Member's bank.

This Agreement is entered into by:

Contractor's signature: .....

Contractor's name: .....

Place: .....

Date: .....

Employer's signature .....

Employer's name: uMkhanyakude District Municipality

Place: .....

Date: .....

Adjudication Board Member's signature: .....

Adjudication Board Member's name: .....

Place: .....

Date: .....

**Delete the inapplicable part*

C2: PRICING DATA

C2.1: PRICING INSTRUCTIONS C2.2: BILL OF QUANTITIES

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C2.1 PRICING INSTRUCTIONS

C2.1 PRICING INSTRUCTIONS

1.0 GENERAL

The Contractor's attention is drawn to the Conditions of Contract, to the Specification and the Tender Drawings, all of which are to be read in conjunction with the Bill of Quantities.

2.0 STANDARD SYSTEM

The Bill of Quantities shall be interpreted in accordance with the method of measurement set out in the Specifications except where variations are implied by the omission of items or by the actual wording of the items in the Bill of Quantities.

The quantities in the Bill of Quantities are provisional. The Works as executed will be measured for payment in accordance with the Bill of Quantities and under the items set forth therein, notwithstanding any custom to the contrary.

In the event of any item to be measured not being reasonably covered by the above Bill, then the Standard Method of Measurement described in Clause 6.7 of the General Conditions of Contract (2015) shall apply and the appropriate rate shall be negotiated between the Engineer and the Contractor.

3.0 MEASUREMENT

Measurement shall be made of the finished work from the net dimensions or masses indicated in the drawings, and no allowance has been made, or will be made for waste.

4.0 PRICES INCLUSIVE

Prices and rates to be inserted in the Bill of Quantities are to be the full inclusive value of the Work described under the several items, but excluding Value Added Tax, which is not to be included in the rates but is to be included in the appropriate item in the Summary Sheet of the Schedule of Quantities.

The items shall, unless otherwise stated herein, be held to include making, conveying and delivering, unloading, storing, unpacking, hoisting, setting, fitting and fixing in position, cutting and waste, laps, patterns, models and templates, labour, plant, fuel, hiring costs, temporary works, return of packings, safety precautions, overheads, on-costs, establishment charges, profit and all other costs and expenses which may be required in and for the construction of the work described together with all risks, liabilities and obligations arising out of the Conditions of Contract or implied in the Documents on which the Tender is to be based. Where special risks, liabilities and obligations cannot be dealt with as above, then the price thereof is to be separately stated in the item provided for the purpose.

5.0 SPECIFICATIONS AND DESCRIPTIONS

Descriptions in the Bill of Quantities are abbreviated, and all Specification Clauses shall be read and deemed to apply to the items described in this Bill of Quantities which are to be priced accordingly.

In the event of any Clause in the preceding Specifications being in conflict with any description and/or amplification thereof in the Bill of Quantities the former shall prevail, and the Project Specification shall take precedence over the General Specification.

Directions and description of work and material given in the Specification are not necessarily repeated in the Bill of Quantities. Reference is to be made to the Conditions of Contract, Specification and other relevant documents for this information. While references may be given in the Bill, such references are not necessarily complete.

6.0 COMPLETION OF BILL OF QUANTITIES

The Bill of Quantities shall be completed in full in black ink.

A price or rate shall be entered against each item where provision is made for such pricing in the Bill of Quantities, whether quantities are stated or not.

No two or more items can be bracketed together for a single price or rate as this will invalidate the tender. Items against which **N/A, left blank or –** is entered are to be considered as incomplete and will invalidate the tender.

Items against which **NIL or zero (0)** is entered are to be considered to be fully priced and the tenderer will provide the items in question as specified at zero (0) or NIL price.

7.0 METHOD OF MEASUREMENT

Quantities have generally been measured in accordance with SABS 1200 Standard Specifications where applicable and where not applicable then generally in accordance with the Sixth Edition (including amendments) of the Standard System of Measuring Builder's Work as issued by the Association of South African Quantity Surveyors unless otherwise stated herein.

7.1 TERMS USED

In this Bill of Quantities the following expressions shall have the meanings hereinafter assigned to them unless otherwise described in the items concerned: -

(i) "ALLOW" Where the word "allow" is used in any item of the Bill of Quantities the sum entered by the Contractor is at his risk and shall cover all costs and charges in respect of the work referred to during the period of the Contract.

(ii) "PROVIDE" Where the word "provide" is used and a sum has been inserted by the Engineer to cover the cost of any particular item of work, the sum so entered shall be dealt with in accordance with the provisions of the General Conditions of Contract.

8.0 APPROVED, DIRECTED OR SELECTED

8.1 The words "approved", "directed" or "selected" refer to the approval, direction or selection of the Engineer.

9.0 TRADE NAMES, PROPRIETARY BRANDS, ETC

All materials, fittings, furnishings, etc., specified under a Trade Name, Proprietary Brand or Catalogue Reference, shall be:

9.1 Used in strict accordance with the Manufacturer's latest printed instructions.

9.2 Either exactly as described or of equal quality, weight or specification and approved by the Engineer.

The Contractor shall first obtain written approval from the Engineer before goods are placed on order from a source of supply other than is specified herein. Such approval shall not be unreasonably withheld.

10.0 MATERIALS AND WORKMANSHIP

All materials shall be the best of their respective kinds specified and the workmanship shall be the standard defined for the trade tests required for such work and to the approval of the Engineer.

In all cases the materials and workmanship shall be in accordance with the latest edition of the relevant

South African Bureau of Standards (SABS) or if not defined therein the British Standard Specification (BSS) or Code of Practice (BSCP) unless otherwise specified.

The quantities given in this Bill should not be used for ordering materials.
The units of measurement described in the Bill of Quantities are metric units for which the standard international abbreviations are used. Abbreviations used in the Bill of Quantities, including some non-standard abbreviations, are as follows:

mm	=	millimeter	h	=	hour	pe	= plain ended
m	=	meter	kg	=	kilogram	FL	= flanged
km	=	kilometre	t	=	ton (1000 kg)	D/FL	= double flanged
m^2	=	square meter	No.	=	number	C/F	= centre to face
sum	=	lump sum	P C sum	=	Prime Cost sum	DN	= Nominal diameter
ha	=	hectare	Prov sum	=	Provisional sum	ID	= Inside diameter
m^3	=	cubic meter	%	=	per cent	OD	= Outside diameter
m^3.km	=	cubic meter-kilometre	kℓ	=	kilolitre	kW	= kilowatt
ℓ	=	litre	MPa	=	megapascal		

C2.2: BILL OF QUANTITIES

UMKHANYAKUDE DISTRICT MUNICIPALITY
HLUHLUWE WATER SUPPLY SCHEME PHASE 2
CONTRACT NUMBER:SCMU 005/2025/2026
COMMAND RESERVOIR & WATER RETICULATION UPGRADE

SCHEDULE OF QUANTITIES

SUMMARY OF BILL OF QUANTITIES		
SECTION	**DESCRIPTION**	**AMOUNT**
1	**PRELIMINARY AND GENERAL**……	
1.1	SECTION 1.1: GENERAL……	
1.2	SECTION 1.2: PROVISIONAL SUM AND DAYWORKS……	
2	**PIPELINES**……	
2.1	SECTION 2.1: SITE CLEARANCE……	
2.2	SECTION 2.2: EARTHWORKS (PIPE TRENCHES)……	
2.3	SECTION 2.3: BEDDING (PIPES)……	
2.4	SECTION 2.4: PIPELINES……	
3	**CONCRETE CHAMBERS AND MECHANICAL**……	
3.1	SECTION 3.1 : CONCRETE SMALL WORKS _CHAMBERS……	
3.2	SECTION 3.2 : PIPELINE CHAMBERS_MECHANICAL……	
4	**RESERVOIR AND RESERVOIR CHAMBERS**……	
4.1	SECTION 4.1: SITE CLEARANCE (RESERVOIR CHAMBERS AND RESERVOIR)……	
4.2	SECTION 4.2: RESERVOIR EARTHWORKS……	
5	**RESERVOIR** ……	
5.1	SECTION 5.1: 3ML RESERVOIR MECHANICAL……	
5.2	SECTION 5.2: COMMAND RESERVOIR MECHANINCAL……	
5.3	SECTION 5.3: WTW 1ML RESERVOIR MECHANICAL……	
5.4	SECTION 5.4: RESERVOIR……	
5.5	SECTION 5.5: RESERVOIR CHAMBERS CONCRETE……	
6	**PIPE JACKING** ……	
7	**LAND ACQUISITIONS** ……	
8	**MISCELLANEOUS**……	
9	**CATHODIC PROTECTION**……	
10	**REFURBISHMENT OF EXISTING RETICULATION MAINS AND ELEVATED TANK CONNECTIONS**……	
	SUB TOTAL	
	ADD 10% CONTINGENCIES OF SUB TOTAL	
	TOTAL CONSTRUCTION COST	
	VALUE ADDED TAX AT 15%	
	BID PRICE CARRIED FORWARD TO FORM OF OFFER AND ACCEPTANCE	

UMKHANYAKUDE DISTRICT MUNICIPALITY
HLUHLUWE WATER SUPPLY SCHEME PHASE 2
CONTRACT NUMBER:SCMU 005/2025/2026
COMMAND RESERVOIR & WATER RETICULATION UPGRADE

SCHEDULE OF QUANTITIES
SECTION 1.1: GENERAL

ITEM NO	LI	PAYMENT REFERS	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 A	**SECTION 1.1: GENERAL**				
		8.3	**SCHEDULED FIXED-CHARGE AND VALUE-RELATED ITEMS**				
1.1-1		PSA 8.3.1	Contractual Requirements	Sum	1		
1.1-2		8.3.2	**Establishment of Facilities on the Site:**				
1.1-3		**PSA 8.3.2.1**	**Facilities for Employer's Agent:**				
1.1-4		PSA 8.3.2.1	(a) Furnished Offices	Sum	1		
1.1-5		PSAB500	(b) Provision of cellular phone (iPhone 15 Pro Max)	Sum	2		
1.1-6		PSA 8.3.2.1 (c)	(c) Provision of name boards	No	2		
1.1-7		PSA 8.3.2.1 (d)	(d) Provision of survey equipment	Sum	1		
1.1-8		PSAB500	Provision of 2.Insta 360 X5 6mm 360 Degree Camera complete with Matterport or insta360 1TB Plan	Sum	1		
1.1-9		PSA 500	Provision of Intel Core i7 (12th Gen or Similar) with a minimum of 8 cores, 16 GB DDR4/DDR5 RAM, 512 GB SSD storage, a 15.6" Full HD display	Sum	2		
		8.3.2.2	**Facilities for Contractor:**				
1.1-10		8.3.2.2 (a)	(a) Offices and storage sheds.	Sum	1		
1.1-11		8.3.2.2 (b)	(b) Workshops.	Sum	1		
1.1-12		8.3.2.2 (c)	(c) Laboratories.	Sum	1		
1.1-13		8.3.2.2 (e)	(e) Ablution and latrine facilities.	Sum	1		
1.1-14		8.3.2.2 (f)	(f) Tools and equipment.	Sum	1		
1.1-15		PSA 8.3.2.2 (g)	(g) Water supplies, electric power and communication.	Sum	1		
1.1-16		8.3.2.2 (h)	(h) Dealing with water as per clause 5.5	Sum	1		
1.1-17		8.3.2.2 (i)	(i) Access as per clause 5.8	Sum	1		
1.1-18		8.3.2.2 (j)	(j) Plant.	Sum	1		
1.1-19		8.3.3	Other fixed-charge obligations. (To be specified)	Sum	1		
1.1-20		PSA 8.3.3.1	Issuing of notices to consumers	Sum	1		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 1.1: GENERAL

			SUB - TOTAL BROUGHT FORWARD				
		PSA 8.3.3.2	**OHS Act Obligations:**				
1.1-21			i) General Safety obligations (incl. provision of personal protective equipment)	Sum	1		
1.1-22			ii) Health and Safety plan/file including health and safety training.	Sum	1		
1.1-23			iii) Fulfil legislated and/or specified requirements for blasting (incl. submission of plans).	Sum	1		
1.1-25		8.3.4	Remove Contractor's Site Establishment.	Sum	1		
1.1-24		PSA 8.3.5.3	Environmental Management Plan Obligations	Sum	1		
		8.4	**SCHEDULED TIME-RELATED ITEMS**				
1.1-26		8.4.1	Contractual Requirements.	Month	18		
1.1-27		PSA 8.4.2	Operate and maintain facilities on the site, for duration of construction, except where otherwise stated	Month	18		
		PSA 8.4.2.1	**Facilities for the Employer's Agent:**				
1.1-28		PSA 8.4.2.1	(a) Furnished Offices with covered carport	Month	18		
1.1-29		PSB 500	Cellular phone airtime and insurances	Sum	18		
1.1-30		PSA 8.4.2.1	(c) Provision of name board	Month	18		
1.1-31		PSA 8.4.2.1	(d) Provision of survey equipment	Month	18		
1.1-32		PSB500	Matterport or insta360 Plan	Month	18		
1.1-33		PSB500	Provision of Intel Core i7 (12th Gen or higher) with a minimum of 8 cores, 16 GB DDR4/DDR5 RAM, 512 GB SSD storage, a 15.6" Full HD display	Sum	18		
		8.4.2.2	**Facilities for Contractor:**				
1.1-34		8.4.2.2 (a)	(a) Office and storage sheds.	Month	18		
1.1-35		8.4.2.2 (b)	(b) Workshops.	Month	18		
1.1-36		8.4.2.2 (c)	(c) Laboratories.	Month	18		
1.1-37		8.4.2.2 (e)	(e) Ablution and latrine facilities.	Month	18		
1.1-38		8.4.2.2 (f)	(f) Tools and equipment.	Month	18		
1.1-40		PSA 8.4.2.2 (g)	(g) Water supplies, electric power and communication.	Month	18		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 1.1: GENERAL

SUB - TOTAL BROUGHT FORWARD							
1.1-41		8.4.2.2 (h)	(h) Dealing with water (Sub-clause 5.5)	Month	18		
1.1-42		8.4.2.2 (i)	(i) Access(Sub-clause 5.8)	Month	18		
1.1-43		8.4.2.2 (j)	(j) Plant.	Month	18		
1.1-44		8.4.3	Contractor's supervision for duration of construction.	Month	18		
1.1-45		8.4.4	Company and Head Office overhead costs for the duration of construction.	Month	18		
1.1-46		8.4.5	Other time related obligations.	Month	18		
		PSA 8.4.6.1	**OHS Act Obligations**				
1.1-47			i) General Safety obligations	Month	18		
1.1-48			ii) Health and Safety plan/file	Month	18		
1.1-49			(iii) Safety Officer	Month	18		
1.1-50		PSA 8.4.6.2	Security Services	Month	18		
1.1-51		PSA 8.4.6.4	Environmental Management Plan Compliance	Month	18		
1.1-52			Allow Provisional Sum for the procurement of Tools and Equipment as required by the Employer	P Sum	1	R 150,000.00	R150,000.00
TOTAL CARRIED FORWARD TO FINAL SUMMARY							

UMKHANYAKUDE DISTRICT MUNICIPALITY
HLUHLUWE WATER SUPPLY SCHEME PHASE 2
CONTRACT NUMBER:SCMU 005/2025/2026
COMMAND RESERVOIR & WATER RETICULATION UPGRADE

SCHEDULE OF QUANTITIES
SECTION 1.2: GENERAL

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 A	**SECTION 1.2: PROVISIONAL SUMS AND DAYWAORKS**				
		PSA 8.5	**SUMS STATED PROVISIONALLY BY THE EMPLOYERS AGENT**				
1.2-1		PSA 8.5.1 (a)	Employment of a Community Liaison Officer (CLO)	Prov Sum	1	R 144,000.00	R144,000.00
1.2-2		PSA 8.5.1 (b)	Percentage allowance on cost on item No. 1.2 - 1 for Contractor's cost and profit.	%			
1.2-3		PSA 8.5.2	Control tests by independent laboratory. Additional tests that may be required by the Engineer over and above normal quality control tests performed by the Contractor.	Prov Sum	1	R 150,000.00	R150,000.00
1.2-4		PSA 8.5.2 (b)	Percentage allowance on cost on item No. 1.2 - 3 for Contractor's cost and profit.	%			
1.2-5		PSA 8.5.3 (a)	Relocation of exisitng services (water mains, electricity cables/poles, etc.) by Services utility	Prov Sum	1	R 300,000.00	R300,000.00
1.2-6		PSA 8.5.3 (b)	Percentage allowance on cost on item No. 1.2 - 5 for Contractor's cost and profit.	%			
1.2-7		PSA 8.5.4 (a)	Additional surveys and underground service detection by nominated specialist as ordered by Engineer	Prov Sum	1	R 300,000.00	R300,000.00
1.2-8		PSA 8.5.4 (b)	Percentage allowance on cost on item No. 1.2 - 7 for Contractor's cost and profit.	%			
1.2-9		PSA 8.5.5 (a)	Provide Training for targeted labour (EPWP). - Refer to Particular Specifivations for Expanded Public Works Programme: Conditions & Specifications	Prov Sum	1	R 180,000.00	R180,000.00
1.2-10		PSA 8.5.5 (b)	Percentage allowance on cost on item No. 1.2 - 9 for Contractor's cost and profit.	%			
1.2-11			Training of local labour				
			i) Generic skills	Prov.Sum	1	R 180,000.00	R180,000.00
			ii) Entreprenaural skills	Prov.Sum	1	R 234,000.00	R234,000.00
			iii) Monthly payment of salary for Students in training	Prov Sum	1	R 216,000.00	R216,000.00
			iv) Payment of labourers whilst under training	Prov Sum	1	R 150,000.00	R150,000.00
1.2-12			Overheads, charges and profit on item 1.2-11 (i), (ii), (iii) and (iv) above	%			
			SUB - TOTAL BROUGHT FORWARD TO NEXT PAGE				

SCHEDULE OF QUANTITIES
SECTION 1.2: GENERAL

			SUB - TOTAL BROUGHT FORWARD FROM PREVIOUS PAGE				
1.2-15			Monthly payment of PSC Members Seating for meetings. R700/person/seating for a maximum of 10 People for 18 months	Prov Sum	1	R 126,000.00	R126,000.00
1.2-16			Percentage allowance on cost on item No. 1.2 - 15 for Contractor's cost and profit.	%			
1.2-17			Social Facilitation	Prov Sum	1	R 400,000.00	R400,000.00
1.2-18			Percentage allowance on cost on item No. 1.2 - 17 for Contractor's cost and profit.	%			
1.2-21			Provisional Sum for Independent Specilist for welding inspections, non-destructive testing, coating and lining inspections and cathodic protection monitoring during construction	Prov.Sum	1	R 3,815,700.00	R3,815,700.00
1.2-22			Percentage allowance on cost on item No. 1.2 -21 for Contractor's cost and profit.	%			
		8.7	**DAYWORKS**				
			DAY WORKS: LABOUR RATES				
1.2-25			(a) Semi-skilled	hr	48		
1.2-26			(b) Unskilled	hr	48		
1.2-27			(c) Construction Hand and Operator	hr	48		
1.2-28			(d) Carpenter	hr	48		
1.2-29			(e) Clerk	hr	48		
1.2-30			(f) Artisans	hr	48		
1.2-31			(g) Foreman	hr	48		
1.2-32			(h) Gangers and Section Leaders	hr	48		
1.2-33			(i) Steel fixer	hr	48		
1.2-34			(j) Bricklayer or Plasterer	hr	48		
1.2-35			(k) Welder	hr	48		
			SUB - TOTAL BROUGHT FORWARD TO NEXT PAGE				

SCHEDULE OF QUANTITIES
SECTION 1.2: GENERAL

			SUB - TOTAL BROUGHT FORWARD FROM PREVIOUS PAGE				
1.2-36			**PLANTHIRE (WORK RATES ON SITE)**				
1.2-37			a) Excavator 20 ton	hr	24		
1.2-38			b) Loader 12 ton	hr	24		
1.2-39			c) Tipper truck 10 m³	hr	24		
1.2-40			d) Water tanker	hr	24		
1.2-41			e) TLB	hr	24		
1.2-42			f) Rollers	hr	24		
1.2-43			g) Generator	hr	100		
1.2-44			h) Up tp 6KVA Generator	Daywk	1		
1.2-45			i) 5 - 10 T Crane truck c/w 10-20T mobile crane	hours	1		
			TRANSPORT COST (TO AND FROM SITE)				
			Note: Distance shall be measured one way only (tender rates shall include for transport in both directions to and from site)				
			Low bed				
1.2-46			a) Low-bed (suitable for the largest piece of equipment above)	km	25		
			Tipper truck				
1.2-47			(a) Small	km	25		
1.2-48			(b) Medium	km	25		
			Flatbed truck				
1.2-49			(a) Small	km	25		
1.2-50			(b) Medium	km	25		
			Water tanker				
1.2-51			(a) Small	km	25		
			SUB - TOTAL BROUGHT FORWARD TO NEXT PAGE				

SCHEDULE OF QUANTITIES
SECTION 1.2: GENERAL

SUB - TOTAL BROUGHT FORWARD FROM PREVIOUS PAGE							
1.2-52			(b) Medium	km	25		
1.2-53			(c) Large	km	25		
			MATERIALS FOR DAYWORKS				
		8.8	**TEMPORARY WORKS**				
1.2-54		8.8.2	Dealing with traffic (or accomodation of traffic) for the duration of the project	Sum	1		
1.2-55		PSA 8.8.4 (d)	Temporary Protection of existing services	Sum	1		
1.2-56		8.8.5	Detail setting out of the Works from survey beacons by a registered surveyor and all other survey related work for the duration of the project.	Sum	1		
1.2-57		PSA 8.8.7	Provision of records/as-built drawings	Sum	1		
TOTAL CARRIED FORWARD TO FINAL SUMMARY							

SECTION 2.1: SITE CLEARANCE

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 C	**SCHEUDLE 2.1: SITE CLEARANCE**				
2.1		**8.2**	**SCHEDULED ITEMS**				
2.1-1		8.2.1	Clear and grub (site servitude 12 m width)	m	18,000		
		8.2.2	Remove and grub large trees and tree stumps of girth:				
2.1-2			a) over 1 m and up to and including 2 m	No	20		
2.1-3			b) over 2 m and up to and including 3 m	No	10		
2.1-4			c) over 3 m and up to and including 4 m	No	5		
2.1-5		8.2.5	Take down existing fences	m	200		
2.1-6		PSC 8.2.11	Reinstate fences to original condition on completion of the scheduled work	m	200		
SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY							

SECTION 2.2: EARTHWORKS (PIPE TRENCHES)

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 DB	**SCHEUDLE 2.2: EARTHWORKS (PIPE TRENCHES)**				
2.2		**8.3**	**SCHEDULED ITEMS**				
		8.3.2	Excavation				
2.2-1			a) (i) Excavation in all materials for trenches including shoring as required and recommendation by Geotech Report and Project Specifications	m^3	25,808		
2.2-2			(ii) Backfill and compaction to trenches to 90% Mod AASHTO density	m^3	45,474		
			b) Extra over item 8.3.2 above for:				
2.2-3			2) Hard rock excavation	m^3	2,323		
2.2-4			c) Excavate and dispose of unsuitable material from trench bottom	m^3	232		
		8.3.3	Excavation Ancillaries				
		8.3.3.1	Make up deficiency in backfill material				
2.2-5			c) by importation from commercial or off-site sources selected by the Contractor including overhaul	m^3	232		
		8.3.4	Particular Items				
2.2-8			a) Shore trench opposite structure or service	m	50		
2.2-9		PSDB 8.3.4.1	Remove and store block or brick paving at the site office until working area is ready for reinstatement	m^2	10		
		8.3.5	Existing services that intersect or adjoin a pipe trench				
2.2-10			a) Services that intersect a trench	No	15		
2.2-11			b) Services that adjoin a trench	m	50		
SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY							

SECTION 2.3: BEDDING (PIPES)

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 LB	**SCHEUDLE 2.3: BEDDING (PIPES)**				
2.3		**8.2**	**SCHEDULED ITEMS**				
		8.2.2.3	**SUPPLY ONLY BEDDING BY IMPORTATION**				
			Bedding from commercial sources (provisional)				
2.3-1			(a) Selected Granular material	m^3	14,426		
2.3-2			Encasing of pipes in concrete (Grade 25 Mpa)	m^3	100		
SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY							

UMKHANYAKUDE DISTRICT MUNICIPALITY
HLUHLUWE WATER SUPPLY SCHEME PHASE 2
CONTRACT NUMBER:SCMU 005/2025/2026
COMMAND RESERVOIR & WATER RETICULATION UPGRADE

SCHEDULE OF QUANTITIES
SECTION 2.4: PIPELINES

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 L	**SCHEUDLE 2.4: PIPELINES**				
2.4		8.2	**SCHEDULED ITEMS**				
			Collect "free issue" pipes, lay,bed, joint and install steel pipes (SANS 719), test and disinfect for the following diameters.				
2,4-1			a) 200mm NB Bell Ended,3LPE Coated and CML Lined Grade X42 6mm Wall Thickness	m	5,400		
		PSL (A1)	i) Extra over inspect, clean repair of defected pipes including reinstatement of defected 3LPE coating and cement mortar lining and cutting of unsuitable steel ends (up to 200mm)	m	1,080		
2,4-2			b) 300mm NB Bell Ended,3LPE Coated and CML Lined Grade X42 4,5mm Wall Thickness	m	4,800		
		PSL (A2)	ii) Extra over inspect, clean repair of defected pipes including reinstatement of defected 3LPE coating and cement mortar lining and cutting of unsuitable steel ends (up to 200mm)	m	960		
2,4-3			c) 350mm NB Bell Ended,3LPE Coated and CML Lined Grade X42 4,5mm Wall Thickness	m	9,954		
		PSL (A3)	iii) Extra over inspect, clean repair of defected pipes including reinstatement of defected 3LPE coating and cement mortar lining and cutting of unsuitable steel ends (up to 200mm)	m	1,991		
2,4-4		8.2.2	**SPECIALS AND FITTINGS**				
			Supply, handle, lay, bed in specified class, join, including cutting pipes according to required lengths, test and disinfect the following specials:				
2,4-5			(a) For 200mm ND pipes bell ended for fillet welding on site. Cement motor lined 4.5mm thick				
			(i) 11.25° bend x 200mm Ø	No	16		
			(ii) 22.25° bend x 200mm Ø	No	12		
			(iii) 45° bend x 200mm Ø	No	14		
			(iii) 90° bend x 200mm Ø	No	12		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 2.4: PIPELINES

			SUB - TOTAL BROUGHT FORWARD					
2,4-6			(b) For 300mm ND pipes with bell ends for fillet welding on site. Steel Cement motor lined 4.5mm thick					
			(i) 11.25° bend x 300mm Ø	No	8			
			(ii) 22.25° bend x 300mm Ø	No	8			
			(iii) 45° bend x 300mm Ø	No	4			
			(iii) 90° bend x 300mm Ø	No	4			
2,4-7			(c) For 350mm ND pipes with bell ends for fillet welding on site. Steel Cement motor lined 4.5mm thick					
			(i) 11.25° bend x 350mm Ø	No	8			
			(ii) 22.25° bend x 350mm Ø	No	11			
			(iii) 45° bend x 350mm Ø	No	8			
			(iii) 90° bend x 350mm Ø	No	7			
2,4-8		8.2.8	**PIPELINE MARKERS "LI"**					
			Manufacture, supply, handle, install and paint marker posts inclusive the cost of listing and submitting a record of the installations to the Engineer	No	400			
2,4-9			**Marking of Valve Chambers**					
			Mark Valve chambers to denote the contents as per project specification	No.	50			
2,4-10			**Concrete encasement and Anchor/thrust blocks and pedestals:**					
			Concrete (including excavations and formwork):					
			Class 30 MPa/19 mm	m³	100			
			Refurbishment of Existing 3LPE Coated and Cement-Mortar Lined Steel Pipes					
2,4-11			Carefully clean and inspect existing steel cement-mortar lined pipe. Identify and mark damaged sections.	Prov. Sum	1	R 150,000.00	R	150,000.00
			Handling Fee	%				
2,4-12			Cut out and remove damaged pipe sections (up to 1 m length) including preparation of pipe ends for rewelding.	Prov. Sum	1	R 100,000.00	R	100,000.00
			Handling Fee	%				
			SUB - TOTAL CARRIED FORWARD TO SUMMARY					

UMKHANYAKUDE DISTRICT MUNICIPALITY
HLUHLUWE WATER SUPPLY SCHEME PHASE 2
CONTRACT NUMBER:SCMU 005/2025/2026
COMMAND RESERVOIR & WATER RETICULATION UPGRADE

SCHEDULE OF QUANTITIES
SECTION 3.1 : CONCRETE SMALL WORKS _CHAMBERS

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 GA	**SECTION 3.1 : CONCRETE SMALL WORKS _CHAMBERS**				
3.1		8.2	**SCHEDULED FORMWORK ITEMS**				
		8.2.1	Rough				
3.1-1			Rough outside formwork vertical to walls and slabs	m^2	250		
		8.2.2	Smooth				
3.1-2			Smooth inside formwork vertical to walls and horizontal to slab	m^2	150		
		8.3	**SCHEDULED REINFORCEMENT ITEMS**				
		8.3.1	Steel Bars				
3.1-3			Plain round steel bars to SANS 920 of the following nominal sizes:	t	3		
3.1-4			High yield round steel bars to SANS 920 of the following nominal sizes:	t	10		
		8.4	**SCHEDULED CONCRETE ITEMS**				
3.1-5		8.4.2	Blinding layer in Grade 15MPa Concrete	m^3	30.00		
3.1-6		8.4.3	Strength Concrete, Grade 30MPa	m^3	65		
			STRUCTURAL STEELWORK (SUNDRY ITEMS)				
			Structural Steel (Type of structure indicated), Supply, fabricate and fix the following fittings:				
			Ladders and Step Irons				
3.1-7			Supply, deliver to site and fix plastic encapsulated step irons placed at 250mm centre to centre, drilled into reinforced concrete, including the necessary grouting	No.	432		
3.1-8			Supply, deliver to site and fix onto roof slab, 16mm ND galvanised mild steel rod for lifting of roof chambers, in accordance with details on the drawing	No.	216		
3.1-9			Supply, deliver to site and fix 100mm ND hot dip galvanised mild steel breather pipes complete with insect gauge screen fabricated from expanded metal, cut and welded onto the pipe opening, and 300mm x 300mm x 6mm thick plate. Welding of insect gauge screen and plate to be done prior to galvanising	No.	54		
			SUB - TOTAL CARRIED FORWARD				

			SUB - TOTAL BROUGHT FORWARD				
3.1-10			Supply, deliver to site and install 600mm x 600mm lockable medium duty tamperproof access manhole cover including frame. Manhole cover to be in accordance with uMkhanyakude District Municipality's specifications	No.	54		
		PSG 8.22	**TEST BLOCKS**				
3.1-11			Making and testing 150 x 150 x 150 mm concrete strength test cubes, all chmabers	No	45		
			SUB - TOTAL CARRIED FORWARD TO SUMMARY				

UMKHANYAKUDE DISTRICT MUNICIPALITY
HLUHLUWE WATER SUPPLY SCHEME PHASE 2
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COMMAND RESERVOIR & WATER RETICULATION UPGRADE

LE OF QUANTITIES
INE CHAMBERS_MECHANICAL

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SABS 1200 L	**SECTION 3.2 : PIPELINE CHAMBERS MECHANICAL** **REFER TO DWG: J000167-WA-DT-212 AIR VALVE CHAMBER PIPE SPECIALS**				
3.2-1			**ITEM 1:** 80mm NB SG FLANGE ADAPTOR. PN16	No	6		
3.2-2			**ITEM 2**: 80mm NB, 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. BOTH ENDS FLANGED, WITH PUDDLE FLANGE AS INDICATED.	No	3		
3.2-3			**ITEM 3:** 80x80mm 90 DEGREE 4,5mm WALL THICKNESS EQUAL TEE	No	3		
3.2-4			**ITEM 4:** 80mm NB FLANGE ADAPTER	No	3		
3.2-5			**ITEM 5**: 80mm NB, 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. ONE END FLANGED, OTHER END PLAIN TO CUT TO SUITE ON SITE WITH PUDDLE FLANGE AS INDICATED.	No	3		
3.2-6			**ITEM 6:** 80mm LONG 50mm NB NIPPLE THREADED SPIGOT ONE END AND OTHER END WELDED TO BLANK FLANGE	No	3		
3.2-7			**ITEM 7:** FEMALE THREAD BALL VALVE	No	3		
3.2-8			**ITEM 8:** 50mm DOUBLE ORIFICE AIR VALVE SPIGOT THREADED	No	3		
			REFER TO DWG: J000167-WA-DT-211 AIR VALVE CHAMBER PIPE SPECIALS				
3.2-9			**ITEM 1**: 200mm NB SG FLANGE ADAPTER PN16	No	6		
3.2-10			**ITEM 2:** 200mm NB, 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE BOTH ENDS FLANGED, WITH PUDDLE FLANGE AS INDICATED. PN16	No	3		
3.2-11			**ITEM 3:** 200x200mm 90 DEGREE 4,5mm WALL THICKNESS EQUAL TEE PN16	No	3		
3.2-12			**ITEM 4:** 200mm NB FLANGE ADAPTER PN16	No	3		
3.2-13			**ITEM 5:** 200mm NB, 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. ONE END FLANGED, OTHER END PLAIN TO CUT TO SUITE ON SITE WITH PUDDLE FLANGE AS INDICATED. PN16	No	3		
3.2-14			**ITEM 6:** 200mm LONG 50mm NB NIPPLE THREADED SPIGOT ONE END AND OTHER END WELDED TO BLANK FLANGE PN16	No	3		
3.2-15			**ITEM 7:** FEMALE THREAD BALL VALVE PN16	No	3		
3.2-16			**ITEM 8:** 50mm DOUBLE ORIFICE AIR VALVE SPIGOT THREADED PN16	No	3		
			SUB - TOTAL CARRIED FORWARD				

			SUB - TOTAL BROUGHT FORWARD				
			REFER TO DWG: J000167-WA-DT-205 AIR VALVE CHAMBER PIPE SPECIALS				
3.2-17		1	**ITEM 1:** 300mm NB, DISMANTLING JOINT PN25	No	12		
3.2-18		2	**ITEM 2:** 300mm NB, STEEL X42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED,PUDDLE FLANGE AS INDICATED. PN25	No	6		
3.2-19		3	**ITEM 3:** 300mm NB , STEEL X42 4,5mm STRAIGHT PIPE ONE END FLANGED OTHER PLAIN TO CUT TOSUIT ON SITE. PN25	No	6		
3.2-20			**ITEM 4:** 300mm NB FLANGE ADAPTOR PN25	No	6		
3.2-21		5	**ITEM 5:** 300mm NB 4,5mm AIR VALVE TEE,FLANGED.PN25	No	6		
3.2-22		6	**ITEM 6:** 300mm NB, STEEL X42 4.5mm STRAIGHT PIPE BOTH ENDS FLANGED, WITH PUDDLE FLANGE AS INDICATED. PN25	No	6		
3.2-23		7	**ITEM 7:** 300mm /80mm BLANK FLANGE:350mm NB FLANGE WITH 80 mm STEEL PIPE, WELDED IN THE MIDDLE OF BLANKFLANGE. PIPE FLANGED WITH 4x6 mm M.S. GUSSET PLATES AS INDICATED.PN25	No	6		
3.2-24		8	**ITEM 8:** 80mm NB BALL VALVE FLANGED.PN25	No	6		
3.2-25		9	**ITEM 9:** 80mm NB DOUBLE ORIFICE AIR VALVE. PN25	No	6		
			REFER TO DWG: J000167-WA-DT-206 AIR VALVE CHAMBER PIPE SPECIALS				
3.2-26			**ITEM 1:** 350mm NB DISMANTLING JOINT PN16	No	38		
3.2-27			**ITEM 2:** 350mm NB MILD STEEL X42 6mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED.PN16	No	19		
3.2-28			**ITEM 3:** 350mm NB MILD STEEL X42 6mm STRAIGHT PIPE ONE END FLANGED OTHER PLAIN TO CUT TO SUITE ON SITE PN16	No	19		
3.2-29			**ITEM 4:** 350mm NB FLANGE ADAPTOR PN16	No	19		
3.2-30			**ITEM 5:** 350mm NB GALVANIZED X42 6mm AIR VALVE TEE FLANGED, PN16	No	19		
3.2-31			**ITEM 6:** 350mm NB MILD STEEL X42 6mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED PN16	No	19		
3.2-32			**ITEM 7:** 350mm/80mm NB BLANK FLANGE,350mm NB FLANGE WITH 80mm STEEL PIPE WELDED IN THE MIDDLE OF BLANK FLANGE,PIPE FLANGED WITH 4X6 mm M.S. GUSSET PLATES AS INDICATED.PN16	No	19		
3.2-33			**ITEM 8:** 80mm NB BALL VALVE FLANGED PN16	No	19		
3.2-34			**ITEM 9:** 80mm NB DOUBLE ORIFICE AIR VALVE PN16	No	19		
			SUB - TOTAL CARRIED FORWARD				

			SUB - TOTAL BROUGHT FORWARD				
		SABS 1200 L	**SECTION 2 : SCOUR VALVES** **REFER TO DWG: J000167-WA-DT-209 SCOUR VALVE CHAMBER PIPE SPECIALS**				
3.2-35			**ITEM 1:** PN 16 FLANGED 80mm NB DISMANTLING JOINTS	No	2		
3.2-36			**ITEM 2:** PN16 FLANGED 80mm NB, 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. PIPE BOTH ENDS PUDDLE FLANGE AS INDICATED.	No	2		
3.2-37			**ITEM 3:** PN16 RESIELENT BUTTERFLY VALVE, RIGHT HAND ACTUATOR	No	1		
3.2-38			**ITEM 4:** PN16 FLANGED 80mm NB FLANGE ADAPTER	No	2		
3.2-39			**ITEM 5:** PN 16 FLANGED 80mm NB 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. ONE END FLANGED, OTHER END PLAIN TO CUT TO SUITE ON SITE AS INDICATED.	No	2		
3.2-40			**ITEM 6:** PN16 FLANGED 90 DEGREE EQUAL TEE 80mm x 80mm	No	1		
3.2-41			**ITEM 7:** PN16 RESIELENT SEAT GATE VALVE, NON-RISING SPINDLE	No	1		
3.2-42			**ITEM 8:** PN 16 FLANGED 80mm NB 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. ONE END FLANGED, OTHER END PLAIN TO CUT TO SUITE ON SITE AS INDICATED. **REFER TO DWG: J000167-WA-DT-207 SCOUR VALVE CHAMBER PIPE SPECIALS**	No	1		
3.2-43			**ITEM 1:** 300mm NB DISMANTLING JOINTS PN25	No	2		
3.2-44			**ITEM 2:** 300mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS REQUESTED.PN25	No	1		
3.2-45			**ITEM 3:** 300mm NB x 150mm NB, STEEL X42 4,5mm 90 DEGREES UNEQUAL TEE FLANGED.PN25	No	1		
3.2-46			**ITEM 4:** 300mm NB, STEELX42 4,5mm STRAIGHT PIPE ONE END FLANGED, OTHER END PLAIN TO CUT TO SUITE ON SITE AS INDICATED PN25	No	1		
3.2-47			**ITEM 5:** 300mm NB FLANGED ADAPTOR PN25	No	1		
3.2-48			**ITEM 6:** 300mm NB BUTTERFLY VALVE, RIGHT HAND ACTUATOR, RIGHT HAND PROJECTION PN25	No	1		
3.2-49			**ITEM 7:** 300mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED PUDDLE FLANGE AS REQUESTED.PN25	No	1		
3.2-50			**ITEM 8:** 150mm NB, STEELX42 4,5mm STRAIGHT PIPE ONE END FLANGED OTHER PLAIN TO CUT TO SUITE ON SITE PN25	No	1		
3.2-51			**ITEM 9:** 150mm NB FLANGED ADAPTOR PN25	No	1		
			SUB - TOTAL CARRIED FORWARD				

			SUB - TOTAL BROUGHT FORWARD				
3.2-52			**ITEM 10:** 150mm NB RESILENT SEAL GATE VALVE.NONE RISING SPINDLE, FLANGED,PN25	No	1		
3.2-53			**ITEM 11:** 150mm NB, STEELX42 4,5mm STRAIGHT PIPE ONE FLANGED THER PLAIN TO CUT TO SUITE ON SITE PUDDLE FLANGE AS INDICATED PN25 **REFER TO DWG: J000167-WA-DT-203 SCOUR VALVE CHAMBER PIPE SPECIALS**	No	1		
3.2-54			**ITEM 1:** 355mm NB DISMANTLING JOINTS PN16	No	8		
3.2-55			**ITEM 2:** 350mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED PN16	No	4		
3.2-56			**ITEM 3:** 350x150mm PN16 FLANGED 90 DEGREE UNEQUAL TEE	No	4		
3.2-57			**ITEM 4:** 350mm NB, STEELX42 4,5mm STRAIGHT PIPE ONE END FLANGED, OTHER END PLAIN TO CUT TO SUITE ON SITE AS INDICATED PN16	No	4		
3.2-58			**ITEM 5:** 350mm NB FLANGED ADAPTOR PN16	No	4		
3.2-59			**ITEM 6:** 350mm NB BUTTERFLY VALVE, RIGHT HAND ACTUATOR, RIGHT HAND PROJECTION PN16	No	4		
3.2-60			**ITEM 7:** 350mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED PN16	No	4		
3.2-61			**ITEM 8:** 150mm NB, STEELX42 4,5mm STRAIGHT PIPE ONE END FLANGED OTHER PLAIN TO CUT TO SUITE ON SITE PN16	No	4		
3.2-62			**ITEM 9:** 150mm NB FLANGED ADAPTOR PN16	No	4		
3.2-63			**ITEM 10:** 150mm NB RESILENT SEAL GATE VALVE.NONE RISING SPINDLE, FLANGED,PN16	No	4		
3.2-64			**ITEM 11:** 150mm NB, STEELX42 4,5mm STRAIGHT PIPE ONE FLANGED THER PLAIN TO CUT TO SUITE ON SITE PUDDLE FLANGE AS INDICATED PN16 **REFER TO DWG: J000167-WA-DT-217 SCOUR VALVE CHAMBER PIPE SPECIALS**	No	4		
3.2-65			**ITEM 1:** 200mm NB SG IRON FLANGE PN16	No	2		
3.2-66			**ITEM 2:** 200mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS REQUESTED.PN16	No	2		
3.2-67			**ITEM 3:** 200mm NB BUTTERFLY VALVE, RIGHT HAND ACTUATOR, RIGHT HAND PROJECTION PN16	No	1		
3.2-68			**ITEM 4:** 200mm NB FLANGED ADAPTOR PN16	No	1		
			SUB - TOTAL CARRIED FORWARD				

			SUB - TOTAL BROUGHT FORWARD				
3.2-47			**ITEM 5:** 200mm NB, STEELX42 4,5mm STRAIGHT PIPE ONE END FLANGED, OTHER END PLAIN TO CUT TO SUITE ON SITE AS INDICATED PN16	No	2		
3.2-48			**ITEM 6:** 200mm NB x 150mm NB, STEEL X42 4,5mm 90 DEGREES UNEQUAL TEE FLANGED.PN16	No	1		
3.2-49			**ITEM 7:** 200mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED PUDDLE FLANGE AS REQUESTED.PN16	No	2		
3.2-50			**ITEM 8:** 150mm NB, STEELX42 4,5mm STRAIGHT PIPE ONE END FLANGED OTHER END PLAIN TO CUT TO SUITE ON SITE PN16	No	1		
3.2-51			**ITEM 9:** 150mm NB FLANGED ADAPTOR PN16	No	1		
3.2-52			**ITEM 10:** 150mm NB RESILENT SEAL GATE VALVE.NONE RISING SPINDLE, FLANGED,PN16	No	1		
3.2-53			**ITEM 11:** 150mm NB, STEELX42 4,5mm STRAIGHT PIPE ONE END FLANGED OTHER END PLAIN TO CUT TO SUITE ON SITE PUDDLE FLANGE AS INDICATED PN16	No	1		
		SABS 1200 L	**SECTION 3 : SPLIT VALVE CHAMBER** **REFER TO DRAWING J000167-WT-DT-216 SPLIT VALVE CHAMBER PIPE SPECIALS**				
3.2-54			**ITEM 1:** 200mm NB DISMANTLING JOINT PN16	No	2		
3.2-55			**ITEM 2:** 200 mm NB STEEL X42, 4,5mm WALL STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED.PN16	No	1		
3.2-56			**ITEM 3**: 200 mm NB STEEL X42 4,5mm STRAIGHT PIPE ONE END FLANGED, OTHER PLAIN TO CUT TO SUIT ON SITE PN16	No	3		
3.2-57			**ITEM 4:** 200mmNB FLANGE ADAPTOR PN 16	No	3		
3.2-58			**ITEM 5:** 200mm NB STEEL X42 RESILENT SEAL GATE VALVE PN20	No	2		
3.2-59			**ITEM 6:** 200 mm NB x 200 mm NB x 200mm NB STEEL X42, 4,5mm 90 DEGREES SWEEP TEE, FLANGED, PN16	No	1		
3.2-60			**ITEM 7:** 350mm NB DISMANTLING JOINT PN16	No	1		
3.2-61			**ITEM 8:** 200 mm NB STEEL X42, 4,5mm WALL STRAIGHT PIPE BOTH ENDS FLANGED,PUDDLE FLANGE AS INDICATED.PN16	No	1		
3.2-62			**ITEM 9:** 350 mm NB-200 mm NB STEEL X42, 4,5mm CONCENTRIC REDUCER PN16	No	1		
3.2-63			**ITEM 10:** 350 mm NB STEEL X42, 4,5mm WALL STRAIGHT PIPE BOTH ENDS FLANGED,PUDDLE FLANGE AS INDICATED.PN16	No	1		
			SUB - TOTAL CARRIED FORWARD				

			SUB - TOTAL BROUGHT FORWARD				
		SABS 1200 L	**SECTION 4 : ISOLATION VALVE** **REFER TO DRAWING J000167-WT-DT-221 ISOLATION VALVE CHAMBER PIPE SPECIALS**				
3.2-64			**ITEM 1:** PN16 FLANGED 350mm NB FLANGE ADAPTER	No	4		
3.2-65			**ITEM 2:** PN16 FLANGED 350mm NB 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. ONE END FLANGED, OTHER END PLAIN TO CUT TO SUITE ON SITE WITH PUDDLE FLANGE AS INDICATED.	No	4		
3.2-66			**ITEM 3:**PN16 FLANGED UNEQUAL LATERAL TEE 350mm x 100mm	No	4		
3.2-67			**ITEM 4:** PN 16 FLANGED 350mm NB 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. BOTH ENDS FLANGED.	No	2		
3.2-68			**ITEM 5:** PN16 RESIELENT BUTTERFLY VALVE, RIGHTHAND ACTUATOR	No	2		
3.2-69			**ITEM 6:** PN16 FLANGED 350mm NB FLANGE ADAPTER	No	2		
3.2-70			**ITEM 7:** PN 16 FLANGED 350mm NB, 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. ONE END FLANGED, OTHER END PLAIN TO CUT TO SUITE ON SITE AS INDICATED.	No	2		
3.2-71			**ITEM 8:** PN 16 FLANGED 100mm NB 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. ONE END FLANGED, OTHER END PLAIN TO CUT TO SUITE ON SITE AS INDICATED.	No	4		
3.2-72			**ITEM 9:** PN16 FLANGED 100mm NB MEDIUM 90 DEGREE BEND	No	4		
3.2-73			**ITEM 10:** PN16 FLANGED 100mm NB BALL VALVE	No	2		
3.2-74			**ITEM 11:** PN16 FLANGED 100mm NB 4,5mm WALL THICKNESS GRADE C STRAIGHT PIPE. BOTH ENDS FLANGED. **REFER TO DWG: J000167-WA-DT-219 ISOLATION VALVE CHAMBER PIPE SPECIALS**	No	4		
3.2-75			**ITEM 1:** 200mm NB SG IRON FLANGE	No	2		
3.2-76			**ITEM 2:** 200mm NB STRAIGHT PIPE ONE END FLANGED, OTHER PLAIN TO CUT TO SUIT ON SITE. PUDDLE FLANGED AS INDICATED PN16	No	2		
3.2-77			**ITEM 3:** 200mm NB FLANGE ADAPTOR PN16	No	2		
3.2-78			**ITEM 4:** 200mm NB RESIELENT SEAT GATE VALVE, NON-RISING. PN16	No	1		
3.2-79			**ITEM 5:** 200mm NB STRAIGHT PIPE BOTH ENDS FLANGED. PUDDLE FLANGED AS INDICATED PN16	No	1		
			SUB - TOTAL CARRIED FORWARD				

			SUB - TOTAL BROUGHT FORWARD				
			REFER TO DWG: J000167-WA-DT-214 ISOLATION VALVE CHAMBER PIPE SPECIALS				
3.2-80			**ITEM 1:** 300mm NB DISMANTLING JOINT PN16	No	2		
3.2-81			**ITEM 2:** 300mm NB STEELGRADE A 4,5mm STRAIGHT PIPE ONE END. FLANGED, OTHER PLAIN TO CUT TO SUITE ON SITE PUDDLE FLANGED AS INDICATED PN16	No	2		
3.2-82			**ITEM 3:** 300mm NB FLANGE ADAPTOR PN16	No	2		
3.2-83			**ITEM 4:** 300mm NB GATE VALVE,NONE RISING SPINDLE PN16	No	1		
3.2-84			**ITEM 5:** 300mm NB STEEL GRADE A 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED. PUDDLE FLANGED AS INDICATED PN16	No	1		
			TOTAL CARRIED FORWARD TO SUMMARY				

UMKHANYAKUDE DISTRICT MUNICIPALITY
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COMMAND RESERVOIR & WATER RETICULATION UPGRADE

SCHEDULE OF QUANTITIES
SECTION 4.1: SITE CLEARANCE (RESERVOIR CHAMBERS AND RESERVOIR)

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 C	**SCHEUDLE 4.1: SITE CLEARANCE (CHAMBERS AND RESERVOIR)**				
		8.3.1	**Site Clearance and Removal of Topsoil**				
4.1-1	LI	8.3.1	a) Clear and grub vegetation	m²	2,346		
4.1-2	LI	8.3.1	c) Remove topsoil with depth of 150mm, stockpile, maintain and replace in surrounding areas once chambers and reservoir is constructed	m^3	352		
			Remove and grub large trees and tree stumps of girth				
4.1-3			(a) over 1m and up to and including 2m	No	200		
4.1-4			(b) over 2m and up to and including 3m	No	50		
SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY							

UMKHANYAKUDE DISTRICT MUNICIPALITY

HLUHLUWE WATER SUPPLY SCHEME PHASE 2

CONTRACT NUMBER:SCMU 005/2025/2026

COMMAND RESERVOIR & WATER RETICULATION UPGRADE

SCHEDULE OF QUANTITIES

SECTION 4.2: RESERVOIR EARTHWORKS

ITEM NO	LI	PAYMENT REFERS TO	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 D	SECTION 4.2: RESERVOIR EARTHWORKS				
		8.3.2	Bulk Excavation				
			(a) Excavation in all materials				
4.1-1			- Cut to spoil	m³	5,900		
			(b) Extra - Over item 3 - B.1 for				
			2) Hard rock excavation				
4.1-2			Cut to spoil	m³	800		
		8.3.4	Importing of Materials				
			(i) Importation and placement of high-tensile strength primary geogrid of 150 mm	m²	2,000		
4.1-3			(ii) Importation and placement of dump rock or coarse crusher stone (35mm-75mm) from commercial sources compacted to 93% Mod AASHTO density	m³	1,500		
4.1-3			(iii) Importation of G5 granular fill from commercial sources compacted to 98% Mod AASHTO density	m³	1,500		
4.1-4			(c) Dealing with overburden	m³	1,800		
4.1.-5		8.3.10	**TOPSOILING**	m³	250		
		8.3.11	**GRASSING**				
4.1-6			(i) Kikuyu (cuttings) including maintaining for duration of contract	m²	1,000		
4.1-7			(ii) Kikuyu (sods) including maintaining for duration of contract	m²	1,000		
SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY							

UMKHANYAKUDE DISTRICT MUNICIPALITY
HLUHLUWE WATER SUPPLY SCHEME PHASE 2
CONTRACT NUMBER:SCMU 005/2025/2026
COMMAND RESERVOIR & WATER RETICULATION UPGRADE

SCHEDULE OF QUANTITIES
SECTION 5.1: 3ML RESERVOIR MECHANICAL

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 GA	**SECTION 5.1: 3ML Reservoir Mechanical**				
		SANS 1200 L	**3ML RESERVOIR PIPEWORK DWG: J000167-WA-DT-400**				
5.1-1			**ITEM 1** - 200MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE SHORT RADIUS BEND, PN 16 FLANGED	No.	2		
5.1-2			**ITEM 2** - 200MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, BOTH ENDS FLANGED	No.	1		
5.1-3			**ITEM 3** - 200MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, BOTH ENDS FLANGED	No.	1		
5.1-4			**ITEM 4** - 200MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, BOTH ENDS FLANGED	No.	1		
5.1-5			**ITEM 5** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE SHORT RADIUS BEND, PN 16 FLANGED	No.	2		
5.1-6			**ITEM 6** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.1-7			**ITEM 7** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE MEDIUM RADIUS BEND, PN 16 FLANGED	No.	2		
5.1-8			**ITEM 8** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, FLANGED BOTH ENDS	No.	1		
5.1-9			**ITEM 9** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE MEDIUM RADIUS BEND, PN 16 FLANGED	No.	1		
5.1-10			**ITEM 10** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, FLANGED BOTH ENDS	No.	1		
5.1-11			**ITEM 11** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.1-12			**ITEM 12** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.1-13			**ITEM 13** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE MEDIUM RADIUS BEND, PN 16 FLANGED	No.	1		
5.1-14			**ITEM 14** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, FLANGED BOTH ENDS	No.	1		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 5.1: 3ML RESERVOIR MECHANICAL

			SUB - TOTAL BROUGHT FORWARD				
5.1-15			**ITEM 15** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.1-16			**ITEM 16** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
			ITEM 13 - 200MM NB BALL VALVE	No.	1		
		SANS 1200 L	**INLET FLOW METER VALVE CHAMBER TO WATER TANK PIPE SPECIALS REFER TO DWG: J000167-WA-DT-213**				
5.1-17			**ITEM 1:** 200mm NB SG IRON FLANGE ADAPTOR. PN16	No.	2		
5.1-18			**ITEM 2:** 200mm NB STRAIGHT PIPE ONE END FLANGED, OTHER PLAIN TO CUT TO SUIT ON SITE. PUDDLE FLANGED AS INDICATED PN16	No.	2		
5.1-19			**ITEM 3:** 200mm NB FLANGE ADAPTOR. PN16	No.	2		
5.1-20			**ITEM 4:** 200mm NB GATE VALVE, NONE RISING SPINDLE. PN16	No.	1		
5.1-21			**ITEM 5:** 200mm NB STRAIGHT PIPE ONE END FLANGED, OTHER PLAIN TO CUT TO SUIT ON SITE. PN16	No.	1		
5.1-22			**ITEM 6:** 200mm NB STRAINER, BOTH ENDS FLANGED, PN16	No.	2		
5.1-23			**ITEM 7:** 200mm NB STRAIGHT PIPE ONE END FLANGED, OTHER PLAIN TO CUT TO SUIT ON SITE. PN16	No.	1		
5.1-24			**ITEM 8:** 200mm NB ELECTROMAGNETIC FLOW METER, BOTH ENDS FLANGED. PN16	No.	1		
5.1-25			**ITEM 9:** 200mm NB STRAIGHT PIPE BOTH ENDS FLANGED. PN16	No.	1		
			ITEM 10: 200mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED. PN16	No.	1		
		SANS 1200 L	**OUTLET VALVE CHAMBER PIPE SPECIALS REFER TO DWG: J000167-WA-DT-201**				
5.1-26			**ITEM 1:** 200mm DISSMANTLING JOINT PN.16	No.	2		
5.1-27			**ITEM 2:** 200mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED. PN16	No.	2		
5.1-28			**ITEM 3:** 200 mm NB-150 mm NB STEEL X42, 4,5mm CONCENTRIC REDUCER PN16	No.	2		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 5.1: 3ML RESERVOIR MECHANICAL

			SUB - TOTAL BROUGHT FORWARD				
5.1-29			**ITEM 4:** 150mm NB STEEL X42 RESILENT SEAL GATE VALVE PN20	No.	1		
5.1-30			**ITEM 5:** 150mmNB FLANGE ADAPTOR PN 16	No.	1		
5.1-31			**ITEM 6**: 150 mm NB STEEL X42 4,5mm STRAIGHT PIPE ONE END FLANGED, OTHER PLAIN TO CUT TO SUIT ON SITE PN16	No.	2		
5.1-32			**ITEM 7:** 150mm FLANGED STRAINER PN16	No.	1		
5.1-33			**ITEM 8:** 150mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED PN16	No.	1		
5.1-34			**ITEM 9:** 150mm MAGFLOW METER PN 16	No.	1		
5.1-35			**ITEM 10:** 150mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED PN16	No.	1		
5.1-36			**ITEM 11:** 200mm NB, DIAMETER STEPPED COUPLING PN.16	No.	1		
		SANS 1200 L	**OUTLET VALVE CHAMBER PIPE SPECIALS** **REFER TO DWG: J000167-WA-DT-220**				
5.1-37			**ITEM 1:** 300mm DISSMANTLING JOINT PN.16	No.	2		
5.1-38			**ITEM 2: 3**00mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED. PN16	No.	2		
5.1-39			**ITEM 3:** 350 mm NB-250 mm NB STEEL X42, 4,5mm CONCENTRIC REDUCER PN16	No.	2		
5.1-40			**ITEM 4:** 250mm NB STEEL X42 RESILENT SEAL GATE VALVE PN20	No.	1		
5.1-41			**ITEM 5:** 250mmNB FLANGE ADAPTOR PN 16	No.	1		
5.1-42			**ITEM 6**: 250 mm NB STEEL X42 4,5mm STRAIGHT PIPE ONE END FLANGED, OTHER PLAIN TO CUT TO SUIT ON SITE PN16	No.	2		
5.1-43			**ITEM 7:** 250mm FLANGED STRAINER PN16	No.	1		
5.1-44			**ITEM 8:** 250mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED PN16	No.	1		
5.1-45			**ITEM 9:** 250mm MAGFLOW METER PN 16	No.	1		
			ITEM 10: 250mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED PN16	No.	1		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 5.1: 3ML RESERVOIR MECHANICAL

			SUB - TOTAL BROUGHT FORWARD				
			ITEM 11: 300mm NB, DIAMETER STEPPED COUPLING PN.16	No.	1		
		SANS 1200 L	**DRAINAGE VALVE CHAMBER PIPE SPECIALS** **DGW: J000167-WT-DT-215**				
5.1-46			**ITEM 1:** 300mmNB FLANGE ADAPTOR PN 16	No.	1		
5.1-47			**ITEM 2:** 300mm STEEL X42 4mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED. PN16	No.	1		
5.1-48			**ITEM 3:** 300mm STEEL X42 45° LATERAL TEE, FLANGED. PN16	No.	1		
5.1-49			**ITEM 4:** 300mm RESILIENT SEAL GATE VALVE, NONE RISING SPINDLE. PN16	No.	1		
5.1-50			**ITEM 5:** 300 mm NB STEEL X42, 4,5mm WALL STRAIGHT PIPE BOTH ONE END FLANGED, PUDDLE FLANGE AS INDICATED.PN16	No.	1		
5.1-51			**ITEM 6:** 300 mm NB STEEL X42, 4,5mm WALL 45° MIDIUM RADIUS BEND, FLANGED. PN16	No.	1		
5.1-52			**ITEM 7:** 300mm STEEL X42 4mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED. PN16	No.	1		
			SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY				

UMKHANYAKUDE DISTRICT MUNICIPALITY
HLUHLUWE WATER SUPPLY SCHEME PHASE 2
CONTRACT NUMBER:SCMU 005/2025/2026
COMMAND RESERVOIR & WATER RETICULATION UPGRADE

SCHEDULE OF QUANTITIES
SECTION 5.2: COMMAND RESERVOIR MECHANINCAL

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 L	**SECTION 5.2: COMMAND RESERVOIR MECHANICAL**				
			4ML RESERVOIR PIPEWORK DWG: J000167-WA-DT-410				
5.2-1			**ITEM 1** - 200MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE SHORT RADIUS BEND, PN 16 FLANGED	No	2		
5.2-2			**ITEM 2** - 200MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, BOTH ENDS FLANGED	No	1		
5.2-3			**ITEM 3** - 200MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, BOTH ENDS FLANGED	No	1		
5.2-4			**ITEM 4** - 200MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, ONE END FLANGED	No	1		
5.2-5			**ITEM 5** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE SHORT RADIUS BEND, PN 16 FLANGED	No.	2		
5.2-6			**ITEM 6** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.2-7			**ITEM 7** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE MEDIUM RADIUS BEND, PN 16 FLANGED	No.	2		
5.2-8			**ITEM 8** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, FLANGED BOTH ENDS	No.	1		
5.2-9			**ITEM 9** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE MEDIUM RADIUS BEND, PN 16 FLANGED	No.	1		
5.2-10			**ITEM 10** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, FLANGED BOTH ENDS	No.	1		
5.2-11			**ITEM 11** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.2-12			**ITEM 12** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, ONE END FLANGED	No.	1		
5.2-13			**ITEM 13** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE MEDIUM RADIUS BEND, PN 16 FLANGED	No.	1		
5.2-14			**ITEM 14** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, FLANGED BOTH ENDS	No.	1		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 5.2: COMMAND RESERVOIR MECHANINCAL

			SUB - TOTAL BROUGHT FORWARD				
5.2-15			**ITEM 15** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.2-16			**ITEM 16** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, ONE END FLANGED	No.	1		
5.2-17			**ITEM 17:** SUPPLY, JOIN, TEST 300MM DIAM. MODEL 753-80 BERMAD LEVEL CONTROL VALVE WITH ALTITUDE PILOT COMPLETE WITH PRESSURE SUSTAINING NORMALLY CLOSED WITH TYPE F LARGE CONTROL FILTER AND V-PORT THROTLING PLUG, PN20.	No.	1		
		SANS 1200 L	**INLET SPLIT VALVE CHAMBER PIPE SPECIALS** **DWG: J000167-WA-DT-200**				
5.2-18			**ITEM 1:** 200mm NB DISMANTLING JOINT PN16	No.	2		
5.2-19			**ITEM 2:** 200 mm NB STEEL X42, 4,5mm WALL STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED.PN16	No.	1		
5.2-20			**ITEM 3**: 200 mm NB STEEL X42 4,5mm STRAIGHT PIPE ONE END FLANGED, OTHER PLAIN TO CUT TO SUIT ON SITE PN16	No.	3		
5.2-21			**ITEM 4:** 200mmNB FLANGE ADAPTOR PN 16	No.	2		
5.2-22			**ITEM 5:** 200mm NB STEEL X42 RESILENT SEAL GATE VALVE PN16	No.	2		
5.2-23			**ITEM 6:** 200 mm NB x 200 mm NB x 200mm NB STEEL X42, 4,5mm 90 DEGREES SWEEP TEE, FLANGED, PN16	No.	1		
5.2-24			**ITEM 7:** 200mm MAGFLOW METER PN 16	No.	1		
5.2-25			**ITEM 8:** 200 mm NB STEEL X42, 4,5mm WALL STRAIGHT PIPE BOTH ENDS FLANGED,PUDDLE FLANGE AS INDICATED.PN16	No.	2		
5.2-26			**ITEM 9:** 300 mm NB-200 mm NB STEEL X42, 4,5mm CONCENTRIC REDUCER PN16	No.	1		
			INTERCONNECTING VALVE CHAMBER PIPE SPECIALS **DWG: J000167-WA-DT-202**				
5.2-27			**ITEM 1: 3**00mm NB DISMANTLING JOINT PN16	No	2		
5.2-28			**ITEM 2:** 300 mm NB STEEL X42, 4,5mm WALL STRAIGHT PIPE BOTH ENDS FLANGED,PUDDLE FLANGE AS INDICATED.PN16	No	1		
5.2-29			**ITEM 3:** 300mm DIAMETER GALVANISED GRADE C, 4,5mm WALL THICKNESS, STRAIGHT PIPE PN 16, ONE END FLANGED	No	1		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 5.2: COMMAND RESERVOIR MECHANINCAL

			SUB - TOTAL BROUGHT FORWARD				
5.2-30			**ITEM 4:** 300mmNB FLANGE ADAPTOR PN 16	No	1		
5.2-31			**ITEM 5: 3**00mm NB STEEL X42 RESILENT SEAL GATE VALVE PN20	No	1		
5.2-32			**ITEM 6:** 300 mm NB STEEL X42, 4,5mm WALL STRAIGHT PIPE BOTH ENDS FLANGED,PUDDLE FLANGE AS INDICATED.PN16	No	1		
		SANS 1200 L	**OUTLET VALVE CHAMBER PIPE SPECIALS** **REFER TO DWG: J000167-WA-DT-220**				
5.2-33			**ITEM 1:** 300mm DISSMANTLING JOINT PN.16	No.	2		
5.2-34			**ITEM 2: 3**00mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED. PN16	No.	2		
5.2-35			**ITEM 3:** 300 mm NB-250 mm NB STEEL X42, 4,5mm CONCENTRIC REDUCER PN16	No.	2		
5.2-36			**ITEM 4:** 250mm NB STEEL X42 RESILENT SEAL GATE VALVE PN20	No.	1		
5.2-37			**ITEM 5:** 250mmNB FLANGE ADAPTOR PN 16	No.	1		
5.2-38			**ITEM 6**: 250 mm NB STEEL X42 4,5mm STRAIGHT PIPE ONE END FLANGED, OTHER PLAIN TO CUT TO SUIT ON SITE PN16	No.	1		
5.2-39			**ITEM 7:** 250mm FLANGED STRAINER PN16	No.	1		
5.2-40			**ITEM 8:** 250mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED PN16	No.	1		
5.2-41			**ITEM 9:** 250mm MAGFLOW METER PN 16	No.	1		
5.2-42			**ITEM 10:** 250mm NB, STEELX42 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED PN16	No.	1		
5.2-43			**ITEM 11:** 300mm NB, DIAMETER STEPPED COUPLING PN.16	No.	1		
		SANS 1200 L	**DRAINAGE VALVE CHAMBER PIPE SPECIALS** **DGW: J000167-WT-DT-215**				
5.2-44			**ITEM 1:** 300mmNB FLANGE ADAPTOR PN 16	No.	1		
5.2-45			**ITEM 2:** 300mm STEEL X42 4mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED. PN16	No.	1		
5.2-46			**ITEM 3:** 300mm STEEL X42 45° LATERAL TEE, FLANGED. PN16	No.	1		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 5.2: COMMAND RESERVOIR MECHANINCAL

			SUB - TOTAL BROUGHT FORWARD				
5.2-47			**ITEM 4:** 300mm RESILIENT SEAL GATE VALVE, NONE RISING SPINDLE. PN16	No.	1		
5.2-48			**ITEM 5:** 300 mm NB STEEL X42, 4,5mm WALL STRAIGHT PIPE BOTH ONE END FLANGED, PUDDLE FLANGE AS INDICATED.PN16	No.	1		
5.2-49			**ITEM 6:** 300 mm NB STEEL X42, 4,5mm WALL 45° MIDIUM RADIUS BEND, FLANGED. PN16	No.	1		
5.2-50			**ITEM 7:** 300 mm NB STEEL X42, 4,5mm WALL 45° MIDIUM RADIUS BEND, FLANGED. PN16	No.	1		
5.2-51			**ITEM 8:** 300mm STEEL X42 4mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED. PN16	No.	1		
			EXISTING 3ML PIPE WORK				
		SANS 1200 L	**EXISTING 3ML RESERVOIR PIPEWORK DWG: J000167-WA-DT-400**				
5.2-51			**ITEM 1** - 200MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE SHORT RADIUS BEND, PN 16 FLANGED	No	2		
5.2-52			**ITEM 2** - 200MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, BOTH ENDS FLANGED	No	1		
5.2-53			**ITEM 3** - 200MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, BOTH ENDS FLANGED	No	1		
5.2-54			**ITEM 4** - 200MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, ONE END FLANGED	No	1		
5.2-55			**ITEM 5:** SUPPLY, JOIN, TEST 350MM DIAM. MODEL 753-80 BERMAD LEVEL CONTROL VALVE WITH ALTITUDE PILOT COMPLETE WITH PRESSURE SUSTAINING NORMALLY CLOSED WITH TYPE F LARGE CONTROL FILTER AND V-PORT THROTLING PLUG, PN20.	No.	1		
		8.2.6	**Box out holes/form voids**				
5.2-56			(b) Small, other than circular, of area up to and including 1 m^2				
5.2-57			Over and up to and including				
5.2-58			(i) 0 - 0.5m deep	No	1		
		8.7	**Grouting**				
5.2-59			Grouting using non-shrinkage grout on reservoir wall pipe box out	No.	1		
			SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY				

UMKHANYAKUDE DISTRICT MUNICIPALITY
HLUHLUWE WATER SUPPLY SCHEME PHASE 2
CONTRACT NUMBER:SCMU 005/2025/2026
COMMAND RESERVOIR & WATER RETICULATION UPGRADE

SCHEDULE OF QUANTITIES
SECTION 5.3: WTW 1ML RESERVOIR MECHANICAL

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 GA SANS 1200 L	**SECTION 5.3: 1ML RESERVOIR MECHANICAL** **1ML RESERVOIR PIPEWORK DWG: J000167-WA-DT-420**				
5.3-1			**ITEM 1** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE SHORT RADIUS BEND, PN 16 FLANGED	No.	2		
5.3-2			**ITEM 2** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.3-3			**ITEM 3** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE MEDIUM RADIUS BEND, PN 16 FLANGED	No.	2		
5.3-4			**ITEM 4** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, FLANGED BOTH ENDS	No.	1		
5.3-5			**ITEM 5** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE SHORT RADIUS BEND, PN 16 FLANGED	No.	2		
5.3-6			**ITEM 6** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.3-7			**ITEM 7** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE MEDIUM RADIUS BEND, PN 16 FLANGED	No.	2		
5.3-8			**ITEM 8** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, FLANGED BOTH ENDS	No.	1		
5.3-9			**ITEM 9** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE SHORT RADIUS BEND, PN 16 FLANGED	No.	2		
5.3-10			**ITEM 10** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.3-11			**ITEM 11** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE MEDIUM RADIUS BEND, PN 16 FLANGED	No.	2		
5.3-12			**ITEM 12** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, FLANGED BOTH ENDS	No.	1		
5.3-13			**ITEM 13** - 300MM DIAMETER GALVANSIED GRADE C, 4,5MM WALL THICKNESS, 90 DEGREE MEDIUM RADIUS BEND, PN 16 FLANGED	No.	1		
5.3-14			**ITEM 14** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, FLANGED BOTH ENDS	No.	1		
SUB - TOTAL CARRIED FORWARD							

SCHEDULE OF QUANTITIES
SECTION 5.3: WTW 1ML RESERVOIR MECHANICAL

			SUB - TOTAL BROUGHT FORWARD				
5.3-15			**ITEM 15** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16 - BOTH ENDS FLANGED	No.	1		
5.3-16			**ITEM 16** - 300MM DIAMETER GALVANISED GRADE C, 4,5MM WALL THICKNESS, STRAIGHT PIPE PN 16, ONE END FLANGED **REFER TO DWG: J000167-WA-DT-214 ISOLATION VALVE CHAMBER PIPE SPECIALS**	No.	1		
5.3-17			**ITEM 1:** 300mm NB DISMANTLING JOINT PN16	No	4		
5.3-18			**ITEM 2:** 300mm NB STEELGRADE A 4,5mm STRAIGHT PIPE ONE END .FLANGED, OTHER PLAIN TO CUT TO SUITE ON SITE PUDDLE FLANGED AS INDICATED PN16	No	4		
5.3-19			**ITEM 3:** 300mm NB FLANGE ADAPTOR PN16	No	4		
5.3-20			**ITEM 4:** 300mm NB GATE VALVE,NONE RISING SPINDLE PN16	No	2		
5.3-21			**ITEM 5:** 300mm NB STEEL GRADE A 4,5mm STRAIGHT PIPE BOTH ENDS FLANGED. PUDDLE FLANGED AS INDICATED PN16	No	2		
		SANS 1200 L	**DRAINAGE VALVE CHAMBER PIPE SPECIALS** **DGW: J000167-WT-DT-215**				
5.1-32			**ITEM 1:** 300mmNB FLANGE ADAPTOR PN 16	No.	1		
5.1-33			**ITEM 2:** 300mm STEEL X42 4mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED. PN16	No.	1		
5.1-34			**ITEM 3:** 300mm STEEL X42 45° LATERAL TEE, FLANGED. PN16	No.	1		
5.1-35			**ITEM 4:** 300mm RESILIENT SEAL GATE VALVE, NONE RISING SPINDLE. PN16	No.	1		
5.1-36			**ITEM 5:** 300 mm NB STEEL X42, 4,5mm WALL STRAIGHT PIPE BOTH ONE END FLANGED, PUDDLE FLANGE AS INDICATED.PN16	No.	1		
5.1-37			**ITEM 6:** 300 mm NB STEEL X42, 4,5mm WALL 45° MIDIUM RADIUS BEND, FLANGED. PN16	No.	1		
5.1-38			**ITEM 7:** 300 mm NB STEEL X42, 4,5mm WALL 45° MIDIUM RADIUS BEND, FLANGED. PN16	No.	1		
5.1-39			**ITEM 8:** 300mm STEEL X42 4mm STRAIGHT PIPE BOTH ENDS FLANGED, PUDDLE FLANGE AS INDICATED. PN16	No.	1		
			SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY				

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CONTRACT NUMBER:SCMU 005/2025/2026
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SCHEDULE OF QUANTITIES
SECTION 5.4: RESERVOIR

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 GA	**SECTION 5.4: RESERVOIR**				
			Construction of reservior as per Drawings				
			Concrete				
5.4-1			Concrete for blinding layer maximum 50 mm thick, class 15/19 including all materials and labour.	m^3	131.25		
5.4-2			Concrete class 30/19 for tank foundation stub footings including, formwork, curing, finishing and all related work.	m^3	550.0		
		SANS 1200G	**Reinforcement**				
5.4-3		8.3.1	Supply and install high tensile steel reinforcement	t	60.00		
			MISCELLANEOUS ITEMS				
5.4-4			Test & disinfect reservoir & related pipe work. Including testing of reservoir for watertightness, testing of roof for watertightness, testing of pipework and valves and cleaning and sterilization.	Sum	3		
			CONSTRUCTION OF 1ML GROUND STEEL TANK				
5.4-5			Supply, deliver, erection and corrossion protection sectional pressed 1ML steel tank on foundation, with roof access, 2 roof vents, catladder, 4 pipe connections float level indicator, flow control and cut off valve, lighting protection and connection to outlet chamber as indicated on the drawings	No	1		
			CONSTRUCTION OF 4ML RESERVIOR				
5.4-6			Supply, deliver, erection and corrossion protection sectional pressed 4ML steel tank on foundation, with roof access, 2 roof vents, catladder, 4 pipe connections, float level indicator, flow control and cut off valve, lighting protection and connection to bulk reticulation complete on position as indicated on the drawings	No	2		
		PSG 8.22	**TEST BLOCKS**				
5.4-7			Making and testing 150 x 150 x 150 mm concrete strength test cubes, all chmabers	No	60		
SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY							

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SCHEDULE OF QUANTITIES
SECTION 5.5: RESERVOIR CHAMBERS CONCRETE

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		SANS 1200 GA	**SECTION 5.5: RESERVOIR CHAMBERS CONCRETE**				
			Construction of Chambers as per Drawings				
			SCHEDULED FORMWORK ITEMS				
			Smooth				
5.5-1			(a) Horizontal	m²	120		
5.5-2			(b) Vertical	m²	210		
5.5-3		8.2.5	Narrow widths (up to 300 mm wide)	m	150		
		8.2.6	Box out holes/form voids				
			(b) Small, other than circular, of area up to and including 1 m2				
			Over and up to and including				
5.5-4			(i) 0 - 0.5m deep	No	30		
		8.3	**SCHEDULED REINFORCEMENT ITEM**				
5.5-5		8.3.1	Mild steel bars (All sizes)	t	10		
5.5-6		8.3.2	High-tensile steel bars (All sizes)	t	30		
		8.4	**SCHEDULED CONCRETE ITEMS**				
5.5-7		8.4.2	Blinding layer (15/19)	m^3	30		
5.5-8		8.4.3	Strength concrete, Grade 30MPa	m^3	100		
		8.4.4	Unformed surface finishes				
5.5-9			(a) Wood-floated finish	m^2	200		
5.5-10			(b) Steel-floated finish	m^2	200		
		8.5	**BONDING OF CONCRETE**				
5.5-11			Apply a dry to dry concrete epoxy adhesive between bottom of beams and to of coloums, all chambers	m^3	50		
		8.7	**Grouting**				
5.5-12			Grouting using non-shrinkage grout on chamber wall pipe box out	No.	10		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 5.5: RESERVOIR CHAMBERS CONCRETE

			SUB - TOTAL BROUGHT FORWARD				
			STRUCTURAL STEELWORK (SUNDRY ITEMS)				
			Structural Steel (Type of structure indicated), Supply, fabricate and fix the following fittings:				
5.5-13			Supply, deliver to site and fix plastic encapsulated step irons placed at 250mm centre to centre, drilled into reinforced concrete, including the necessary grouting	No.	210		
5.5-14			Standard 600 x 900mm 3CR12 Manhole covers	No.	3		
5.5-15			600 x 600 Polymere concrete cover and frame lockable or similar, medium duty tamperproof access manhole cover including frame.	No.	18		
5.5-16			Supply, deliver to site and fix 100mm ND hot dip galvanised mild steel breather pipes complete with insect gauge screen fabricated from expanded metal, cut and welded onto the pipe opening, and 300mm x 300mm x 6mm thick plate. Welding of insect gauge screen and plate to be done prior to galvanising	No.	30		
5.5-17			Supply, deliver to site and fix onto roof slab, 16mm ND galvanised mild steel rod for lifting of roof chambers, in accordance with details on the drawing	No.	120		
		PSG 8.22	**TEST BLOCKS**				
5.5-18			Making and testing 150 x 150 x 150 mm concrete strength test cubes, all chmabers	No	48		
			SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY				

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SCHEDULE OF QUANTITIES
SECTION 6: PIPE JACKING

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
			SCHEDULE 6: PIPE JACKING				
6.1-1			**Jacking establishment:**				
			a) Fixed charges	Sum	1		
			b) Time-related charges	Sum	1		
			Grouting: Injection of cement/sand grout, where ordered				
			a) Provide equipment and remove on completion	Sum	1		
			b) Operate equipment	Days	5		
			c) Materials	m³	10		
6.1-2			**Supply and lay ND 500 mm diameter 120D concrete jacking pipe:**				
			(a) Jack 1	m	50		
6.1-3			**Supply and lay ND 350 mm diameter 120D concrete jacking pipe:**				
			(a) Jack 2	m	20		
6.1-4			**Extra-over Item 6.1-2(a) and 6.1-2(b) for:**				
			(a) excavation in rock using pneumatic tools or other techniques.	m³			Rate Only
			Standing time for pipe jacking team complete with equipment (where approved)	hr			Rate Only
SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY							

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SCHEDULE OF QUANTITIES
SECTION 7: LAND ACQUISITIONS

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
		PS	**LAND ACQUISITION *(SERVITUDES, WAYLEAVES, BUILDING SITES, ETC.)***				
			Compensation, Servitude or Land Acquisition				
7.1-1			Provision for Servitude Registration, Land Acquisition and Compensation	P/Sum	1	R350,000.00	R350,000.00
			Handling fee	%			
			SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY				

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SCHEDULE OF QUANTITIES
SECTION 8: MISCELLANEOUS

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
			SCHEDULE 8: MISCELLANEOUS				
			FENCE AND GATE				
8.1-1			Supply and install (Rate all inclusive), 2m high concrete palisade fencing and double leaf gates as per drawing J000167-WT-LA-400, including associated poles and all materials for stabilsing, concrete supports, etc	m	400		
SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY							

UMKHANYAKUDE DISTRICT MUNICIPALITY
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SCHEDULE OF QUANTITIES
SECTION 9: CATHODIC PROTECTION

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
			SCHEDULE 9: CATHODIC PROTECTION				
			Cathodic Protection (CP) and AC Interference Mitigation (ACIM). This work was done by a specialist professional services provider and a selected specialist contractor & therefore becomes nominated sub-contractors to this contract				
			Nominated specialist CP Contractor. As specialist appointed by main contractor as sub-contractor				
9.1-1			**Fixed Charge Items**				
9.1-1.1			To include for Contractual Requirements, Start up documentation, Site Establishment and Dis-Establishment and all other fixed charged Obligations.	Sum	1		
9.1-2			**Time-Related Items**				
9.1-2.1			To include for all time related requirements, travel, accommodation, messing living out and upliftment, transport and haulage, personnel , safety, quality and all other aspects regarding the day to day operations on site and head office to carry out the works. To include for CDT as per NACE.	Months	6		
			Permanent SACP Magnesium Anode Station (No: 36)				
9.1-3			**Supply**				
9.1-3.1			Supply Vandal Resistant 50MPa Enclosure SACP Test Point	Sum	36		
9.1-3.2			Supply SACP-TP foundation & cable encasement materials	Sum	36		
9.1-3.3			Supply Conduits / Sleeves / Ducting - Below Grade to Above Grade	Sum	36		
9.1-3.4			Supply SACP-TP In-Situ Cast Surround (0.5m x 0.5m x 0.25m) (40MPa)	Sum	36		
9.1-3.5			Supply IP66 Polycarbonate Enclosure	Sum	36		
9.1-3.6			Supply IP66 Glands	Sum	432		
9.1-3.7			Supply "IR Free" SANS 53509 Annex G Type D Coupon Card	Sum	36		
9.1-3.8			Supply all internal terminals and all SACP internal ancillary equipment	Sum	36		
9.1-3.9			Supply SANS 53509 Annex G Type D Coupon including cabling	Sum	36		
9.1-3.10			Supply SANS 53509 Annex G Type D Portable CSE including cabling	Sum	36		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 9: CATHODIC PROTECTION

			SUB - TOTAL BROUGHT FORWARD				
9.1-3.11			Supply SANS 53509 Annex G Type D Haber Probe/Tube Facility	Sum	36		
9.1-3.12			Supply SANS 53509 Annex G Type D CSE Service Enclosure/Facility	Sum	36		
9.1-3.13			Supply ASTM B843 Gr M1C Temporary Anode & Ancillary Materials	Sum	36		
9.1-3.14			Supply SANS 53509 Annex G Type D - Haber Probe Electrolyte	Sum	36		
9.1-3.15			Supply SANS 1507/1411 - 2 x 16mm² (Black) PVC/PVC Cables	m	1080		
9.1-3.16			Supply Magnesium Anodes - ASTM B843 Type M1C 10kg (550mm long)	Sum	72		
9.1-3.17			Supply Magnesium Anodes - 10mm² Cu/PVC/PVC SANS 1507 Cabling	m	2160		
9.1-3.18			Supply Compacted Anode Backfill (Gypsum/Bentonite/Sodium Sulphate)	m3	9		
9.1-3.19			Supply Water Solution (20% Sodium Bicarbonate) Anode Wetting	m3	9		
9.1-3.20			Supply Stud Welding Studs & Ancillary Equipment	Sum	36		
9.1-3.21			Supply Canusa Wrapidbond FST (profiling mastic - Stud weld area)	Sum	36		
9.1-3.22			Supply Canusa Wrapidbond Tape (inner - 450mm wide)	Sum	36		
9.1-3.23			Supply Canusa Wrapidcoat PVC Tape (outer - 550mm wide)	Sum	36		
9.1-3.24			Supply of IF Kits (Insulation GasketFiber Glass and Epoxy)	Sum	6.48		
9.1-4			**Install**				
9.1-4.1			SACP System - All civil and mechanical requirements	Sum	36		
9.1-4.2			Hand Excavation (SACP Test Post & Expose Pipe & SACP Cabling)	Sum	36		
9.1-4.3			Anode Trench Excavation (1500mm deep x 350mm width x 15.5m (Max))	m	558		
9.1-4.4			Install Vandal Resistant 50MPa Enclosure SACP Test Point	Sum	36		
9.1-4.5			Install SACP-TP Foundation & cable encasement materials	Sum	36		
9.1-4.6			Install Conduits / Sleeves / Ducting - Below Grade to Above Grade	Sum	36		
9.1-4.7			Install SACP-TP In-Situ Cast Surround (0.5m x 0.5m x 0.25m) (40MPa)	Sum	36		
9.1-4.8			Install IP66 Polycarbonate Enclosure	Sum	36		
9.1-4.9			Install IP66 Glands	Sum	432		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 9: CATHODIC PROTECTION

			SUB - TOTAL BROUGHT FORWARD				
9.1-4.10			Install "IR Free" SANS 53509 Annex G Type D Coupon Card	Sum	36		
9.1-4.11			Install all internal terminals and all SACP internal ancillary equipment	Sum	36		
9.1-4.12			Install SANS 53509 Annex G Type D Coupon including cabling	Sum	36		
9.1-4.13			Install SANS 53509 Annex G Type D Portable CSE including cabling	Sum	36		
9.1-4.14			Install SANS 53509 Annex G Type D Haber Probe/Tube Facility	Sum	36		
9.1-4.15			Install SANS 53509 Annex G Type D CSE Service Enclosure/Facility	Sum	36		
9.1-4.16			Install ASTM B843 Gr M1C Temporary Anode & Ancillary Materials	Sum	36		
9.1-4.17			Install SANS 53509 Annex G Type D - Haber Probe Electrolyte	Sum	36		
9.1-4.18			Install SANS 1507/1411 - 2 x 16mm² (Black) PVC/PVC Cables	m	1080		
9.1-4.19			Install Magnesium Anodes - ASTM B843 Type M1C 10kg (550mm long)	Sum	72		
9.1-4.20			Install Magnesium Anodes - 10mm² Cu/PVC/PVC SANS 1507 Cabling	m	2160		
9.1-4.21			Install Compacted Anode Backfill (Gypsum/Bentonite/Sodium Sulphate)	m3	9		
9.1-4.22			Install Water Solution (20% Sodium Bicarbonate) Anode Wetting	m3	9		
9.1-4.23			Install Stud Welding Studs & Ancillary Equipment	Sum	36		
9.1-4.24			Install Canusa Wrapidbond FST (profiling mastic - Stud weld area)	Sum	36		
9.1-4.25			Install Canusa Wrapidbond Tape (inner - 450mm wide)	Sum	36		
9.1-4.26			Install Canusa Wrapidcoat PVC Tape (outer - 550mm wide)	Sum	36		
9.1-4.27			ASTM G62 Coating Testing (No Holidays @ 15KV)	Sum	36		
9.1-4.28			Install Insulating Gaskets	Sum	6.48		
			Electrical Continuity Bonding (No: 34)				
9.1-5			**Supply**				
9.1-5.1			Supply Pipe Negative Cable - 2 x 16mm² PVC/PVC SANS 1507	m	68		
9.1-5.2			Supply Stud Welding Studs & Ancillary Equipment	№	68		
9.1-5.3			Supply Canusa Wrapidbond FST (profiling mastic - Stud weld area)	№	34		
			SUB - TOTAL CARRIED FORWARD				

SCHEDULE OF QUANTITIES
SECTION 9: CATHODIC PROTECTION

			SUB - TOTAL BROUGHT FORWARD				
9.1-5.4			Supply Canusa Wrapidbond Tape (inner - 450mm wide)	№	34		
9.1-5.5			Supply Canusa Wrapidcoat PVC Tape (outer - 550mm wide)	№	34		
9.1-6			**Install**				
9.1-6.1			Hand Excavation (Expose Pipes Couplings)	№	34		
9.1-6.2			Install Pipe Negative Cable - 2 x 16mm² PVC/PVC SANS 1507	m	68		
9.1-6.3			Install Stud Welding Studs & Ancillary Equipment	№	68		
9.1-6.4			Install Canusa Wrapidbond FST (profiling mastic - Stud weld area)	№	34		
9.1-6.5			Install Canusa Wrapidbond Tape (inner - 450mm wide)	№	34		
9.1-6.6			Install Canusa Wrapidcoat PVC Tape (outer - 550mm wide)	№	34		
9.1-6.7			ASTM G62 Coating Testing (No Holidays @ 15KV)	№	68		
9.1-7			**Energising, Pre Commissioning and Hand-Over**				
9.1-7.1			Commissioning - SACP Stations with Engineer & Data Logging	Sum	18		
			SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY				

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SCHEDULE OF QUANTITIES
SECTION 10: REFURBISHMENT OF EXISTING RETICULATION MAINS AND ELEVATED TANK CONNECTIONS.

ITEM NO	LI	PAYMENT REFERENCE	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
			SCHEDULE 8: REFURBISHMENT OF EXISTING RETICULATION MAINS AND ELEVATED TANK CONNECTIONS				
			EXISTING RETICULATION NETWORK				
10.1-1			Refurbishment of existing water reticulation mains, including the replacement or repair of aged and damaged pipeline sections, fittings, and valves, as well as the rehabilitation and reconnection of elevated storage tank inlet and outlet connections at the existing elevated Tank with no water supply	Prov. Sum	1	R1,124,104.13	R 1,124,104.13
			Handling Fee	%			
SUB - TOTAL CARRIED FORWARD TO FINAL SUMMARY							

C3: SCOPE OF WORK

C3.1: DESCRIPTION OF WORK

C3.2: ENGINEERING

C3.3: PROCUREMENT

C3.4: CONSTRUCTION

C3.5: MANAGEMENT

C3.6: STANDARD SPECIFICATIONS

C3.7: PROJECT SPECIFICATIONS

C3.8 PARTICULAR SPECIFICATIONS

C3.1: DESCRIPTION OF WORKS

C3.1.1 Scope of Works

The detailed scope of work that will be carried out in this contract is described below:

1. Earthworks for buried pipelines and reservoir foundations
2. Construction of New Steel Pipelines complete with Isolation, Flow Meters, Air Valve and Scour Valve Chambers, details and length description as per below table:

Hluhluwe Phase 2: Phase A: Scope of Works		
Description	**Units**	**Quantity**
Upgrade of Existing Rising Main Pipelines (WTW to Command Reservoir)		
350mm NB Steel pipeline Grade X42,4,5mm Wall Thickness,CML,3LPE Coated , Bell Ended	m	3 000
Construction of Bulk Supply Pipelines		
350mm NB Steel pipeline Grade X42,4,5mm Wall Thickness,CML,3LPE Coated , Bell Ended	m	6 642
200mm NB Steel pipeline Grade X42,4,5mm Wall Thickness,CML,3LPE Coated , Bell Ended - Tee to Mfekayi North Reservoir	m	1 100
200mm NB Steel pipeline Grade X42,4,5mm Wall Thickness,CML,3LPE Coated , Bell Ended - Tee to Nkundusi & Elevated tank	m	550
200mm NB Steel pipeline Grade X42,4,5mm Wall Thickness,CML,3LPE Coated , Bell Ended	m	1 587
Connector Reticulation		
300mm NB Steel pipeline Grade X42,4,5mm Wall Thickness,CML,3LPE Coated , Bell Ended	m	1 763
200mm NB Steel pipeline Grade X42,4,5mm Wall Thickness,CML,3LPE Coated , Bell Ended	m	2 075
Total Length	**m**	**16 717**

3. Construction of New Rectangular Pressed Steel Ground Level Reservoirs complete with scour, overflow, inlet and outlet pipework, earthworks and foundations, details of location and capacity as per table below:

Description	**Location**	**Quantity**
New 1 Mℓ Rectangular Pressed Steel Ground Level Clear Water Tank	Hluhluwe WTW	1
New 4 Mℓ Rectangular Pressed Steel Ground Level Reservoir	Command Reservoir Site	1
New 4 Mℓ Rectangular Pressed Steel Ground Level Reservoir	Mfekayi – Ward 22	1

C3.1.2: Site Location

The project falls under uMkhanyakude District Municipality (UKDM), within Mtubatuba Local Municipality, it is located in the north-eastern area of KwaZulu-Natal. It is located along the coastal zone in the province's north-east.

The works are located within UKDMS's Hluhluwe Water Supply Scheme, the coordinates of the various sites are listed in the Table below:

	Site / Description	Latitude (S)	Longitude (E)
1	Hluhluwe Water Treatment Works (WTW) – commencement point	-28.147128°	32.267214°
2	Command Reservoir Site – proposed 4 ML additional reservoir	-28.167692°	32.249236°
3	Mfekayi – proposed 4 ML service reservoir	-28.182416°	32.297638°

The figure below shows the project footprint



Project Locality Map

C3.1.3: Location of Pipe Yards (free Issue for Pipes by the Employer)

The location of the pipe yards where the free issue pipes to be supplied by the Employer will be collected are described below with relevant coordinates for detailed planning and pricing purposes the Contractor shall ensure they evaluate the location of the paipeyards for the purposes of preparing an all inclusive lump sum rrate to cover transportation and handling of the pipes from the pipe yards to the site as per coordinates isued:

Makhonyeni 1 (27°27'32.6"S 32°07'24.2"E)



Makhonyeni 2 (27°27'47.5"S 32°07'12.0"E)



Ophande (27°30'20.3"S 32°06'16.6"E)





C3.1.4: Access to Site

The works are accessed via an informal double-lane gravel road. The surface is unsealed, compacted aggregate with intermittent potholes, ruts and shallow crossfall. The alignment includes short, slightly steep sections (gentle to moderate gradient) and several crests; drainage is limited in places and stormwater frequently causes surface erosion and softening of the running surface after rain.

Vehicle access & restrictions

- Recommended vehicle type: 4×4 light-duty vehicles for routine site attendance and equipment transport.
- Conditional access for smaller vans: Small delivery vans and LDVs can access the site in dry conditions only and at reduced speed; wet-season access for these vehicles is not reliable due to softening and rutting.

C3.1.5 Temporary Works

The Contractor is responsible to design and provide all temporary works required for this Contract. Temporary works shall include those works required to provide and maintain suitable access to and within the pipe yards from which pipe is to be drawn and the control of vegetation in terms of this specification. The Contractor shall be responsible to obtain the use of suitable land for the site camp and to pay all rentals due and fulfil the requirements of the landowner and others connected thereto. The Contractor shall be responsible to establish, maintain and secure his/her site office, workshop, storage facilities for pipes, plant, equipment, fittings, fuel, lubricants and all other materials required in the performance of this contract, together with all items of the requirements of the contract as described in C3 of this document.

C3.2 ENGINEERING

C3.2.3 Drawings

The drawings issued to tenderers as part of the tender documents must be regarded as provisional and preliminary for the tenderer's benefit to generally assess the scope of work. The drawings are issued separately to this document.

At commencement of the contract, the Employer's Agent will deliver to the Contractor three copies of the construction drawings and any instructions required for the commencement of the works. From time to time thereafter during the progress of the works, the Employer/ Employer's Agent may issue further drawings or revisions for construction purposes as may be necessary for construction, completion and defects correction of the works. The work shall be carried out in accordance with the latest available revision of the drawings approved for construction.

The following drawings are applicable to the Contract and are bound separately:

Part	DWG No.	Description
A: Layout Plan	J000167-WT-DL-000	Drawing List
A: Layout Plan	J000167-WT-LA-001	Ward Layout
A: Layout Plan	J000167-WT-LA-002	General Layout Plan
A: Layout Plan	J000167-WT-LA-003	Command Reservoir Site Layout
A: Layout Plan	J000167-WT-LA-004	3 ML Reservoir Site Layout
A: Layout Plan	J000167-WT-LA-005	1 ML Clear Water Tank Site Layout
B: Plan & Long Section (100–102)	J000167-WT-LS-100	Plan and Long Section 300 mm NB, Water Treatment Works to Existing 3 ML Reservoir (CH 0.00–CH 1000.00), Sheet 1 of 3
B: Plan & Long Section (100–102)	J000167-WT-LS-101	Plan and Long Section 300 mm NB, Water Treatment Works to Existing 3 ML Reservoir (CH 1000.00–CH 2000.00), Sheet 2 of 3
B: Plan & Long Section (100–102)	J000167-WT-LS-102	Plan and Long Section 300 mm NB, Water Treatment Works to Existing 3 ML Reservoir (CH 2000.00–CH 3009.00), Sheet 3 of 3
C: Plan & Long Section (110–116)	J000167-WT-LS-110	Plan and Long Section 355 mm NB, Command Reservoir to Proposed 3 ML Reservoir (CH 0.00–CH 1000.00), Sheet 1 of 7
C: Plan & Long Section (110–116)	J000167-WT-LS-111	Plan and Long Section 355 mm NB, Command Reservoir to Proposed 3 ML Reservoir (CH 1000.00–CH 2000.00), Sheet 2 of 7
C: Plan & Long Section (110–116)	J000167-WT-LS-112	Plan and Long Section 355 mm NB, Command Reservoir to Proposed 3 ML Reservoir (CH 2000.00–CH 3000.00), Sheet 3 of 7
C: Plan & Long Section (110–116)	J000167-WT-LS-113	Plan and Long Section 355 mm NB, Command Reservoir to Proposed 3 ML Reservoir (CH 3000.00–CH 4000.00), Sheet 4 of 7
C: Plan & Long Section (110–116)	J000167-WT-LS-114	Plan and Long Section 355 mm NB, Command Reservoir to Proposed 3 ML Reservoir (CH 4000.00–CH 5000.00), Sheet 5 of 7
C: Plan & Long Section (110–116)	J000167-WT-LS-115	Plan and Long Section 355 mm NB, Command Reservoir to Proposed 3 ML Reservoir (CH 5000.00–CH 6000.00), Sheet 6 of 7

Part	DWG No.	Description
C: Plan & Long Section (110–116)	J000167-WT-LS-116	Plan and Long Section 355 mm NB, Command Reservoir to Proposed 3 ML Reservoir (CH 6000.00–CH 7007.00), Sheet 7 of 7
E: Chambers & Concrete Details	J000167-WT-DT-200	Inlet Split Valve Chamber – Concrete Details and Pipe Specials (200 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-201	Flow Meter Valve Chamber – Concrete Details and Pipe Specials (300 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-202	Isolation Valve Chamber – Concrete Details and Pipe Specials (300 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-203	Scour Valve Chamber Type 2 – Concrete Details (355 mm ND), Sheet 1 of 2
E: Chambers & Concrete Details	J000167-WT-DT-204	Scour Valve Chamber Type 2 – Pipe Specials (355 mm ND), Sheet 2 of 2
E: Chambers & Concrete Details	J000167-WT-DT-205	Air Valve Chamber – Concrete Details and Pipe Specials (300 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-206	Air Valve Chamber – Concrete Details and Pipe Specials (355 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-207	Scour Valve Chamber Type 2 – Concrete Details (300 mm ND), Sheet 1 of 2
E: Chambers & Concrete Details	J000167-WT-DT-208	Scour Valve Chamber Type 2 – Pipe Specials (300 mm ND), Sheet 2 of 2
E: Chambers & Concrete Details	J000167-WT-DT-209	Scour Valve Chamber Type 2 – Concrete Details (80 mm ND), Sheet 1 of 2
E: Chambers & Concrete Details	J000167-WT-DT-210	Scour Valve Chamber Type 2 – Pipe Specials (80 mm ND), Sheet 2 of 2
E: Chambers & Concrete Details	J000167-WT-DT-211	Air Valve Chamber – Concrete Details and Pipe Specials (80 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-212	Inlet Flow Meter Valve Chamber – Concrete Details and Pipe Specials (200 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-213	Isolation Valve Chamber – Concrete Details and Pipe Specials (300 mm ND)

Part	DWG No.	Description
E: Chambers & Concrete Details	J000167-WT-DT-215	Drainage Valve Chamber – Concrete Details and Pipe Specials (300 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-216	Split Valve Chamber – Concrete Details and Pipe Specials (355×200 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-217	Scour Valve Chamber Type 2 – Concrete Details (200 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-218	Scour Valve Chamber Type 2 – Pipe Specials (200 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-219	Isolation Valve Chamber – Concrete Details and Pipe Specials (200 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-220	Outlet Flow Meter Valve Chamber – Concrete Details and Pipe Specials (200 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-221	Isolation & Bypass Valve Chamber – Concrete Details (355 mm ND)
E: Chambers & Concrete Details	J000167-WT-DT-222	Isolation & Bypass Valve – Pipe Specials (355 mm ND)
G: Miscellaneous	J000167-WT-DT-300	Name Board
G: Miscellaneous	J000167-WT-DT-301	Typical Road Deviation Next to the Road
G: Miscellaneous	J000167-WT-DT-302	Typical Road Deviation for Road Crossing

The Contractor will be required to mark up one complete set of prints of the construction drawings with all relevant as-built information and to submit these to the Employer's Agent Representative prior to issue of the Certificate of Practical Completion.

C3.2.4.2 Design of Temporary Works

The Contractor will be responsible for the design of all temporary works and all construction methods, including those for the tie-ins and interconnecting works and all shoring and lateral support that may be required for trenching. The Contractor will also be responsible for the preparation of method statements as required and for preparing designs for the removal,

relocation and/or reconstruction of certain existing facilities on privately owned properties that will be affected by the construction of the new pipeline.

The Contractor shall be responsible for the layout of his site camp and fabrication areas, construction and other working areas, management of the pipe yards and all temporary works, including construction access, culverts and drainage. The Contractor shall also be responsible for providing and maintaining suitable access to and within the pipe yards designated for the collection of 'free issue' pipe together with the fencing and control of vegetation of the pipe yards.

The Contractor is referred to the Employer's Environmental Specification and Environmental Management Programme (EMPr) in regard to all aspects of the temporary works.

C3.2.4.3 Other Documentation Required from Contractor

Operation and Maintenance Manual

The Contractor shall be responsible to produce the Operations & Maintenance (O & M) Manual for the Works. The O & M manual shall document all requirements for correct operation and maintenance of the works. Two draft copies of the O & M Manual shall be issued to the Employer's Agent prior to commissioning of the Works. Before the Certificate of Practical Completion is issued (after the successful completion of the Trial Operational Period) four final copies of the final approved version of the O & M Manual shall be issued to the Employer's Agent.

Binders with hard plastic covers and four-ring spring clip holders shall be used. Binders shall not be over-filled to allow use without damage to the contents. A spare binder shall be provided for every three used, marked with the contract information. At least one set shall contain original copies.

The manual shall be of a standard acceptable to the Employer's Agent. Title labels which include contract number, title, location, Contractor's name as well as the equipment or fittings used together with volume number and contents shall be fixed on the front as well as the spine of the binders.

Manuals shall be in English only, with sections of equipment arranged by labelled dividing separator sheets. Where standard literature is obtained from suppliers or manufacturers, this shall be neatly photocopied in A4 size, with the applicable sections clearly marked, omitting duplicate sections in languages other than English.

Comprehensive indexes shall be included, with separate sections (with their own index) where required, as follows:

- Record (as-built) drawings referenced to the drawings list.

- Fittings and equipment supplied • A comprehensive schedule of routine maintenance for the works.

C3.3 Procurement

C3.3.1 Preferential procurement procedures

C3.3.1.2 Resource standard pertaining to targeted procurement

The Employer has determined that 100% of the Contractor's unskilled labour force shall be made up from the Local Municipality area. Local labour employed on the contract shall be paid in accordance with the local labour rate and all statutory conditions of employment shall be met including registration with the Unemployment Insurance Fund.

C3.3.1.3 Contracts of Employment

All employees of the Contractor shall be issued with a written contract of employment which shall be signed by the Contractor and the employee. The contracts shall be in isiZulu and in English.

Contracts of employment shall incorporate, inter alias, the following:

- personal particulars.
- job title and job description.
- employment period, including any probation period, which probation period shall not exceed 13 weeks.
- hours of work, statutory holidays, vacation, sick leave.
- remuneration, including wage rates for overtime, and any monetary allowances and deductions applicable to any probationary period and the time after its satisfactory completion.
- method of payment.
- medical and any other social benefits.
- conditions precedent to termination of employment.

Contracts of employment shall be accompanied by a written statement of company procedures covering such matters as training, promotion and redundancy policies, procedures for dealing with grievances, disciplinary procedures, protective clothing and occupational safety, and the like.

C3.3.1.3 Induction Programme

Before starting training or regular working, all employees shall attend an induction programme at which, inter alia, methods of working, site safety procedures, environmental policies, and the employees' role in relation to them shall be addressed. The employees shall be given an introduction to the Contractor's general industrial relations policy and procedures, covering such subjects as selection for promotion and redundancy, any bonus schemes, procedures for dealing with grievances, disciplinary procedures, and the like. The Contractor shall be responsible for compiling, organising and executing this induction programme.

C3.3.1.4 In-task Training

In-task training of the workforce is a general responsibility of the Contractor to ensure that his workforce is sufficiently skilled, Health and Safety aware and environmentally compliant as per the Employer's Environmental Specification. The Contractor shall provide in-task training of local labour during the construction of the works and at this own cost. In-task training shall consist of training and guidance of team leaders, assistants, and labour in those construction activities where the labour is engaged. The in-task training shall cover all training and guidance required to ensure that the leaders and labour are able to carry out the project tasks in accordance with the requirements of the project specification.

All personnel involved in construction shall also be trained in the Employer's Environmental Management System. The in-task training shall be carried out by the Contractor's own key and skilled personnel or by a mentor appointed for the purpose and approved by the Employer.

C3.3.2 Enhancing Participation through Labour Intensive Construction

It is the intention of the Employer to enhance local employment as far as possible. Certain tasks may be suitable for use of labour-intensive methods. The Contractor shall plan his works in general to make maximum use of labour-intensive methods in addition to the use of plant where appropriate.

The tasks that may be suitable for use of labour-intensive methods are:

- Pipeline trench excavation in soft material for trench depths not exceeding 1,5m depth.
- Placement of bedding cradle and bedding blanket.
- Backfilling of pipe trenches
- Construction of Gravelled access roads

Within four weeks of commencement the Contractor shall present a plan for utilization of labour indicating the sectors of work where labour intensive construction is proposed, the estimated labour complement and programme. This plan will be for discussion with the CLO and Employer.

Machine excavation shall be used where the classification of excavation is 'intermediate' or 'hard' and for excavation of pipe trenches beyond 1,5m in depth. Machine excavation may also be used where the community reports that the work is too hard for manual labour. The CLO will be the liaison person in this respect.

C3.3.3 Subcontracting

This sub-section covers the subcontracting of specialist work at the Contractor's choice, mandatory sub-contracting to local SMMEs and the use of selected sub-contractors identified by the Employer.

C3.3.3.1 Subcontracting at Contractor's choice

Subcontracting of specialised portions of the work is permitted in principle up to a maximum of twenty five percent (25%) in total of the approved contract value. Should the Tenderer wish to employ Sub-Contractors of his own choice for part of the works, this is to be clearly indicated in Schedule T of the Returnable Schedules, showing the full names and addresses of all proposed Sub-Contractors for which approval of the Employer's Agent is sought and stating the section of the works that each will be handling.

Subsequent to contract award the written approval of the Employer shall be required prior to the engagement of any sub-contractor not proposed in the tender and accepted by the Employer. The appointment of subcontractors shall only be formalised on the basis of the presentation of a suitable and compliant sub-contracting agreement in the CIDB format or other acceptable format.

C3.3.3.2 Mandatory Subcontracting – SMMEs

Mandatory sub-contracting to local SMME's also applies under this contract (refer C3.3.1.1). The process of mandatory sub-contract work shall be as follows:

1. The Contractor shall indicate on his programme at what stage the sub-contractors will be required for the various work items
2. The Employer's ISD Consultant shall identify eligible candidates as Local Emerging Subcontractors and present these to the Contractor ahead of the deadline for appointing the subcontractors.
3. The Contractor shall select from the identified Local Emerging Sub-Contractors.

In the event that the Employer's ISD Consultant fails to identify sufficient available candidates as Local Emerging Sub-Contractors ahead of the deadline for the employment of such subcontractors, as shown on the Contractor's approved programme, the Contractor shall be released from the obligation of mandatory subcontract work and shall be free to appoint a sub-contractor of his own choice or to undertake the work directly using own resources.

C3.4 Construction

C3.4.1 Applicable Specifications

C3.4.1.1 Standard Specifications

The standard specifications on which this contract is based are the South African Bureau of Standards Standardised Specifications for Civil Engineering Construction SABS 1200 as listed in C3.6 of the Scope of Work. The various SANS specifications referred to in this document are listed in C3.6 and the Contractor is advised to obtain them from Standards South Africa (a division of SABS) in Pretoria.

The standardised specifications (SABS 1200) must be read in conjunction with the new SANS 1921 family of standards. In case of any discrepancy or conflict between the two, the SABS 1200 specification shall take precedence and shall govern.

Refer also to the Preface on interim situation until full suite of SANS 2001 Series of Specifications is available, on the first page of the Project Specification.

The term “project specifications” appearing in any of the SABS 1200 standardised specifications is deemed to be equivalent to the term “scope of work” in SANS Specifications.

The variations and additions to the standard specifications are prefixed PS and take precedence over the SABS Standardised Specification.

Where a particular specification is in conflict with either the variations and additions to standardized specifications or the SABS Standardised Specifications, the specifications shall take precedence.

C3.4.5.2.4 *Management of Pipe Yards* The steel pipe stock will be supplied by the Employer on 'free issue' basis from the existing pipe yard(s) in the vicinity of the work area. The location of the pipe yards shall be communicated during the site visit at Tender Stage it is the responsibility of the Contractor during pricing to reference this location or make any further enquiries to develop a firm price for the handling of free issue pipes. The Contractor shall be responsible for inspecting and uplifting the pipes for transport to the work site. Pipes indicated as defective shall be marked up at the point of defect and transported to the nearest pipe manufacturer capable of making repairs to make remedials on the pipe, the contractor shall during pricing consider the nearest pipe manufacturer capable of reparing coating and lining and factor in such costs in the overall pricing for repair of free issue pipes. Once the pipe has been uplifted for transport the pipe becomes the responsibility of the Contractor and the remedying of any subsequent damage shall be for the Contractor's account.

The Contractor shall be responsible for the maintenance of the pipe yard(s) and the access to pipe yard, to the degree adequate to the Contractor's requirements for safe handling and transport of the pipes. This shall include access onto and around the site, drainage and control of vegetation and maintenance of perimeter fencing and firebreaks.

To lessen the risk of fire damage the whole site should be cleared and kept clear of bushes and shrubs, subject to the Environmental Specification and Environmental Management Plan. The grass on the whole site is to be cut to a height of no more than 25 mm and maintained at a height not exceeding 50 mm.

When steel pipes are moved for any reason steel pipes must be stored off the ground and secured from rolling using suitable dunnage, such as sandbags. The steel pipes may not be stacked. An average space of 300 mm should be allowed between parallel pipes, the end-to-end gap between pipe stacks should be 5 m and the gap between pipes and the perimeter fence should be at least 6 m which includes the 5 m wide firebreak.

C3.4.5.2.5 *Storage and laboratory facilities*

No storage facilities will be available or provided by the Employer. The Contractor is responsible to make suitable arrangements to deliver materials as and when required for erection purposes and when called for by the Employer's Agent, whether such call be issued on or after the delivery date offered by the Tenderer.

C3.4.5.2.6 *Water*

Where the Contractor wishes to make use of potable water supply the Contractor's responsibility shall include to provide a suitable connection, if so approved, including a suitable flow meter. This connection shall be capped or removed to the satisfaction of the Employer's Agent upon completion of the construction works. All costs in regard to supply of water shall be deemed to be included in the rates for the establishment and dis-establishment of the site facilities. The Contractor will be required to supply, install, operate and maintain at his cost, such temporary pipework and storage facilities as may be necessary to ensure sufficient supply.

The Contractor will also be required to pay all connection fees and for the cost of all water drawn from the water supply authority's system at the ruling tariffs and his tender will be held to include for all such requirements throughout the duration of the Contract. The water for testing and disinfecting the three pressed steel tanks to be installed shall be supplied by the contractor with adequate volumes at his own costs included In his pricing, the

Water for human consumption shall be required to conform to SABS 241 for potable water. The Contractor shall be responsible for his arrangements for supply and treatment of water to required quality standards and to demonstrate the acceptable quality of the water by means of an analysis certificate from an accredited laboratory.

C3.4.5.2.7 Electricity

The Contractor shall make his own arrangements concerning the supply of power. The Contractor will be required to pay all the requisite connection and consumption charges for whatever temporary power supplies he may require for his use on the site. No direct payment will be made for the provision of power. The cost thereof shall be deemed to be included in the rates and amounts tendered for the various items of work for which this service is required, or in the Contractor's preliminary and general items as the case may be.

C3.4.5.2.8 Telecommunication services

The Contractor is to provide his own telephone facilities on site. No telephone will be required for the use of the Employer's Agent or his representative. An item has been included in the Bill of Quantities to cover the costs of the Employer's Agent Representative cellular phone calls for the duration of the Contract.

C3.4.5.2.9 Vehicles and equipment

The Contractor shall provide, at his own cost, a suitable vehicles for the exclusive use of the Engineer's team for the duration of the Contract. An item has been included under *Preliminary and General (P&G) items* in the Bill of Quantities to cover such costs.

1. Vehicle Type

The vehicle shall be a 4x4 Light Delivery Vehicle (LDV), double cab, with adequate load capacity and ground clearance to access construction and remote project sites.

The vehicle shall be maintained in good working order at all times, and shall comply with all applicable road traffic and licensing requirements in South Africa.

2. Maintenance & Running Costs

The Contractor shall be responsible for all routine and non-routine maintenance of the vehicle, including servicing, tyres, repairs, licensing, and roadworthiness certification.

The Contractor shall cover all reasonable fuel costs, lubricants, consumables, toll fees, and related operational expenses.

3. Insurance

The vehicle shall be comprehensively insured by the Contractor, including third-party liability, passenger liability, theft, and accident cover.

Proof of valid insurance cover shall be submitted to the Engineer prior to mobilisation and kept up to date throughout the Contract period.

4. Availability

The vehicle shall be made available to the Engineer's team for the full duration of the Contract, commencing from the Date of Possession of Site until issuance of the Final Completion Certificate, unless otherwise directed by the Employer.

The vehicle shall be dedicated for the Engineer's use during working hours and project site visits.

5. Replacement & Contingency

In the event of breakdown, accident, or unavailability of the designated vehicle, the Contractor shall immediately provide a replacement vehicle of equivalent or better specification at no additional cost to the Employer.

C3.4.6 Permits and way leaves

The Employer will obtain the necessary approvals, and the Contractor will be required to comply with the authorities and landowners' / occupiers' requirements at all times.

The Contractor will be required to take cognisance of, and comply with, the general wayleave and 'permission to occupy' requirements of the authorities and landowners / occupiers during the construction of the works. Specific wayleave requirements are listed immediately following this section.

The Contractor will be required to confirm that permission has been granted and that the occupiers and all affected parties have been informed of the Contractor's intentions before commencing work on each property.

C3.4.6.1 Eskom's Wayleave Conditions

Eskom has prescribed the following conditions:

"No excavation may be carried out within a 10m radius of the foot of any Eskom structure measured from the inner edge of trench. Where civil work is done outside of this radius the soil must be suitably sloped and protected so as not to cause erosion in or onto the 10m radius of undisturbed soil.

Operators of vehicles and machinery must be made aware of danger of working beneath power lines.

No explosives may be used within 500m of Eskom structures without prior consent (with 14 working days' notice required).

No exposure of foundations of Eskom structures is permitted.

Clearances from live conductors must be maintained as per Regulation 15 of the Electrical Machinery Regulations (OHS Act No. 85 of 1993)

No dumping of rubble, earth etc is allowed within the Eskom servitude area.

Changes in ground level may not infringe statutory clearances to conductors.

After any change in ground level, the surface to be rehabilitated and stabilized to Eskom's satisfaction."

C3.4.6.2 Designated Working Strip and other Working Areas

The working strip width as stated in C3 or as shown on drawings shall apply to this contract. The Contractor is alerted to the fact that certain landowner, statutory and utility owner permissions that apply to the contract apply solely within the working strip and other designated working areas and that carrying out work or using a travelling way outside of these designated areas without prior permission may result in delay and/or financial and other sanctions that may not constitute valid grounds for claim for disruption, delay and financial complication.

The Contractor shall therefore be required to obtain the permission of the Employer's Agent in writing before establishing stockpiles, set-down and storage areas, carrying out temporary or permanent works and for travelling/transportation other than on formal roads.

Measurements for payment for site clearance, rehabilitation and all other activities shall apply solely to areas within the working strip and other designated working areas unless expressly provided for in writing.

C3.4.7 Alterations, Additions, Extensions and Modifications to Existing Works

The Contractor must satisfy himself that the layout of the existing structures and plant is compatible with the proposed works and must advise the Employer's Agent of any conflicts.

Alterations to existing services will require prior written authorisation by the Client.

C3.4.8 Water for construction purposes

The Contractor shall make his own arrangements regarding water for construction purposes and shall be responsible to provide suitable transport as well as abstraction arrangements.

C3.4.9 Survey control and setting out of the works

The Contractor will be responsible for the setting out of the works.

Survey Beacons (Read with SANS 1921 - 1: 2004 clause 4.15)

The Contractor shall take special precautions to protect all permanent survey beacons or pegs such as benchmarks, stand boundary pegs and trigonometrical beacons, regardless whether such beacons or pegs were placed before or during the execution of the Contract. If any such beacons or pegs are disturbed by the Contractor or his/her employees, the Contractor shall have them replaced by a registered land surveyor at his/her own cost.

C3.5 Management

C3.5.1 Management of the works

C3.5.1.1 Applicable SANS 1921 Specifications

The following SANS 1921 Construction and Management requirements for works standards and associated specification data are applicable:

SANS 1921-1 General engineering and construction works

SANS 1921-2 Accommodation of Traffic on Public Roads

SANS 1921-6 HIV/AIDS Awareness

C3.5.1.2 Particular and Generic Specifications

The applicable Particular Specifications and Generic Specifications are included in section C3.8 of this specific

C3.5.1.3 Specification Data

The specification data applicable to these SANS 1921 standards is as follows:

Standard	Clause	Essential Data
SANS 1921-1	4.1.7	The requirements for drawings, information and calculations for which the Contractor is to be responsible are detailed in the project specifications.
	4.2.1	The responsibility strategy assigned to the Contractor for the works is A.
	4.2.2	The Structural Engineer for the works is Zimile Consulting Engineers.

	4.3.1	The planning, programme and method statements are to comply with the following: 1) The programme shall be prepared in bar (Gantt) chart form, preferably using a project management software tool such as *Microsoft Project* and shall be issued to the Employer's Agent in both hard copy and electronic format. The programme shall be structured to cover all items of work including all work to be done by sub-contractors and shall clearly indicate the critical path 2) The programme must clearly show the milestone dates to be achieved taking the indicative construction sequences into account. 3) The programme shall be updated whenever the circumstances of the work execution change and whenever instructed by the Employer's Agent. Each revision of the programme shall be marked with a sequential revision number. The Contractor's programme shall be subject to approval by the Employer's Agent. 4) Method statements shall be prepared by the Contractor for any procedures proposed by the Contractor for use in the contract as well as in accordance with the requirements of the project specifications.

Standard	Clause	Essential Data
SANS **1921-1**	4.4	The Contractor will be solely responsible for the production of work that complies with the Specifications to the satisfaction of the Employer's Agent. To this end it will be the full responsibility of the Contractor to institute an appropriate Quality Assurance (QA) system on site. The Contractor's QA system shall be open to audit by the Employer's Agent to verify that adequate independent checks and tests are being carried out and to ensure that the Contractor's own control is sufficient to identify any possible quality problems which could cause a delay or failure. The Contractor shall ensure that efficient supervisory staff, the required transport, instruments, equipment and tools are available to control the quality of his own workmanship in accordance with his QC&QA system. His attention is drawn to the fact that it is not the duty of the Employer's Agent or the Employer's Agent Representative to act as foreman or surveyor.
	4.5	The Contractor will be required to verify the accuracy of all survey control provided on the drawings or in the form of beacons previously placed on the site. Prior to setting out, the Contractor shall also check the invert levels of all existing tie-in channels, manholes, pipes etc. against those provided on drawings and immediately report any inconsistencies to the Employer's Agent in writing. The Contractor shall be held directly responsible for any errors in setting out of the works arising from use of the survey control or existing invert levels provided.

	4.5.1	It is important that, during construction, the Contractor checks all levels from time to time and satisfies himself as to their accuracy prior to placing of concrete as no concrete work will be accepted where tolerances have been exceeded, particularly where it interferes with the hydraulics of the flow through the works. The maintenance of gravelled temporary deviations and existing gravel roads used for construction shall include the watering of roads daily in the dry season for reduction of dust.
	4.6	An item has been included in the Schedule of Quantities to cover all work in dealing with water.
	4.12.2	The samples of materials, workmanship and finishes that the contractor is to provide and deliver to the Employer are: 1) Pipes and Jointing methods 2) Pipe coatings and corrosion protection of pipes and fittings 3) Repair and make-goods of pipe coatings and linings 4) Welding procedures (If any) 5) Proof of Welders' qualifications 6) Pipe bedding materials 7) Concrete aggregate 8) Concrete sand 9) Concrete mix designs 10) Reinforcing The fabrication drawings that the Contractor is to provide and deliver to the Employer are those for all fabricated fittings, specials and bends, the reservoir ladders and any prefabricated items that the Contractor proposes to use in the permanent works.

Standard	**Clause**	**Essential Data**
SANS **1921-1**	4.14.3	The office accommodation, equipment, accommodation for site meetings and other facilities for use by the employer and his agents are as designated in SABS 1200 AB (refer PSAB). 1) Safety helmets, gumboots and other necessary safety equipment for the sole use of the employer and his agents 2) Survey equipment as per PSAB 4.2 3) No testing laboratory is required on site for use by the Employer's Agent
	4.14.5	Toilet facilities are required for the Employer and his agents.
	4.14.6	The requirements for the provision and erection of sign boards are: 1) As per SABS 1200 AB and C4

	4.17.1	The requirements for the termination, diversion, or maintenance of existing services are: 1) Support in-situ of existing water mains up to and including DN 300 crossing pipe trench 2) Deviation of small diameter water house connection pipes and fittings. 3) Support in-situ of existing stormwater drainpipes up to and including DN 600 crossing pipe trench 4) Deviation and relocation of electrical power cables as domestic power connections – work is to be carried out by the responsible utility owner under the overall co-ordination of the Contractor. Provisional sums are provided for this purpose. 5) Temporary deviation and accommodation of traffic
	4.17.2	Where public services must be interrupted on account of the works, it shall be the Contractor's responsibility, in conjunction with the appropriate Authority to ensure that all users affected by the interruption are given due and sufficient notice of the date, time and duration of the interruption.
	4.17.3	Services which are known to exist on the site are: 1) Telephone line and electricity lines 2) Buried power cables 3) Water pipelines 4) Stormwater pipes and catchpits 5) Roads and tracks The approximate positions of some of the known underground services, which may be affected by the Works, have been shown on the drawings. The exact location or number or existence of these services cannot be guaranteed and the Contractor will be required to confirm the locations and status of all services with all service owners irrespective of whether they are shown on the drawing or not.
SANS 1921-1	4.17.5	If unknown services are found undamaged, they shall then be deemed to be known services with the provisions pertaining to known services becoming applicable.

Standard	Clause	Essential Data
	4.17.6	Where a service has been located and exposed, the Contractor shall take every care in ensuring that the excavation containing the service is barricaded and protected against collapse and that the service is adequately protected against damage. Should the existing service become damaged by the Contractor or any third party due to negligence on part of the Contractor, then the cost of its repair along with any consequential costs shall be borne by the Contractor.
	4.17.7	Existing known services or services that have been proved by the Contractor, which are damaged by the Contractor, shall be repaired by the service provider and all costs of the repair shall be borne by the Contractor.
	4.18	The additional health and safety requirements of the Employer are as specified in the health and safety specification included in C3.8 of this document.
	4.18.2	The site office area, pipe yard, the servitude/working strip and all other construction zones shall be fenced off to prevent unauthorized entry to the site. Gates shall be provided by the Contractor as required for construction access purposes. The Contractor shall be held responsible for the control of access at these gates at all times as well as to the worksite during removal and re-erection of fencing. No other opening in the fence shall be permitted and the Contractor shall be responsible for monitoring the fencing on a daily basis and repairing any such opening within the same day that it is detected. Notices in two official languages (English and isiZulu) shall be attached to the fence where appropriate to indicate that the site is for personnel employed on the Contract only and that unauthorised entry is forbidden. The temporary fencing shall comprise 2m high Bonnox 4 x 4 Mesh fencing, Bonnox pattern 1972/4, with straining posts and straining wires as required and according to supplier's directions and with mesh spacing not exceeding 100mm in both the vertical and horizontal directions. Chevron tape shall be interwoven in a zig zag pattern from the top to the bottom of the fence thereby clearly marking off the working area. At weekends or holidays the site must be completely closed off to the public. It is the responsibility of the Contractor to ensure that the sites are closed off. Standard type farm gates can be used for access points and locked when the Contractor is not in attendance. All fencing and gates must be maintained until the work is complete and shall then be removed.

		In proximity to residential areas the Employer's Agent may specify the addition of plastic square mesh to the temporary fencing, or equivalent method, to acts as a childproof barrier to prevent child access to pipe trenches.
	4.22	The work to be undertaken by selected subcontractors comprises the supply and installation of cathodic protection devices and equipment, the environmental rehabilitation of the site and provision and installation of telemetry equipment.

Standard	Clause	Variations
SANS 1921-1	4.1.10	Where reference is made to "SANS 2001", substitute with "SABS 1200"

Standard	Clause	Additional Clauses
SANS 1921-1	4.4	The Contractor is required to set up and maintain a Quality Management system and Quality Assurance process. The requirements are detailed elsewhere in this document.
	4.5	The Contractor is required to submit Method Statements for specific items of work as identified in this specification and wherever the Contractor proposes his own approach or method of working. In order to avoid delays to work Method Statements must be submitted well in advance of the proposed work (at least 10 working days or such suitable time as agreed with the Employer's Agent Representative) and are subject to the approval of the Employer's Agent.
	4.6 (e)	The Contractor is to ensure that stormwater runoff or any groundwater seepage is controlled by means of temporary earthworks, cofferdams, pumping equipment, well-pointing, de-watering equipment etc. to keep the works free of water.
	4.6 (f)	Dealing with all water during construction from whatever source will include for by-pass arrangements for dealing with all possible flows whether or not the existing flow path is being interfered with during installation of pipework.

	4.7.4	No blasting will be permitted within 10 m of any structure, pipeline or service unless the Contractor can satisfy the Employer's Agent that his proposed blasting methods and controls are such that no damage will be caused to the adjoining structure, pipeline or service. The Contractor will be required to provide equipment for and take vibro-recordings at no additional cost to the Employer.
	4.8.1	The Contractor shall be responsible for protection from damage to any structures or services that might be affected by the excavations or works.
	4.8.2	Notwithstanding whatsoever special construction methods, equipment or materials are used by the Contractor to protect the structure or service from damage, all work will be measured for payment on the assumption that normal excavation had been carried out and the Contractor shall therefore make allowance for the additional costs in his tendered rates.
	4.9.5	The provision of security for the Contractor's site establishment, plant and personnel at all times is the sole responsibility of the Contractor and no claims for payment for additional security measures taken during the contract will be entertained.
	4.9.6	The Contractor is to comply with the Environmental Management Plan and Employer's Environmental Management Specification included as a Particular Specification in Section C3.8.
	4.17.8	The Contractor shall confine his so carry out all his operations as not to encroach on, or interfere with, trespass on, or damage adjoining land, buildings, properties, road structures, pipelines, places and things, in the vicinity of the Works and outside of the site boundary.

Standard	**Clause**	**Essential Data**
SANS 1921-2	4.3.2	The Contractor shall design all temporary culverts.

	4.10.1	The Contractor shall provide the following minimum traffic-control facilities: a) flagmen with traffic STOP and GO signs b) road signs, channelization devices and New Jersey type movable barriers c) all construction vehicles and plant used on the works must be equipped with rotating amber flashing lights and warning boards with the words CONSTRUCTION VEHICLE in 250 mm high red letters on a white background.

Standard	Clause	Variations
SANS 1921-2	4.3.2	**Variations** The Contractor shall be responsible for the design of all temporary deviations.

Standard	Clause	Essential Data
SANS 1921-5	4.2.1	The means of determination of method of Excavation (i.e. by hand or machine excavation) shall be as per PSDB5.4.1. The depth of trenches which are to be excavated by hand is less than or equal to 1,5m and providing that the ground is stable.

Standard	Clause	Essential Data
SANS 1921-6	4.2.1 a)	A qualified service provider is one that appears on the list of recommended service providers, which is available from all regional offices of the Department of Public Works.
	4.2.1 a)	The HIV & AIDS awareness programme is to be repeated at 6 monthly intervals for the duration of the Contract (including the initial one at the start of the Contract).

Standard	Clause	Variations
SANS 1921-6	4.3.2	The HIV & AIDS Awareness Champion and the Employer's representative shall certify the report and schedule described in 4.3.1 whenever a claim for payment is issued to the Employer.

Standard	Clause	Additional Clauses
SANS **1921-6**	4.1 f)	Appointing an HIV & AIDS Awareness Champion within 14 days of site handover from amongst the workers (which could include the Community Liaison Officer). The champion should be able to speak, read and write English, speak and understand the local languages spoken by the Workers and shall be on site at all stages of the construction period. The Contractor shall ensure that the Awareness Champion has been trained by the Service Provider on basic HIV & AIDS information, the support services available and has the necessary skills to handle questions regarding the HIV & AIDS programme in a sensitive and confidential manner. The Awareness Champion shall be responsible for: • Liaising with the Service Provider to assist in organising awareness workshops • Filling condom dispensers and monitoring condom distribution • Handing out information booklets • Placing and maintaining posters
	4.1 g)	Provide information about the names of the closest service providers to be displayed on a poster of size not smaller than A2.
	4.2.3 c)	Understand and communicate the purpose of voluntary HIV & AIDS testing and counselling.
	4.2.3 d)	Recognise the importance of caring for people living with HIV & AIDS and be familiar with the various treatments available, including treatment of opportunistic infections.
	4.2.3 e)	Understand and communicate the rights and responsibilities of those living with HIV & AIDS in the workplace and the importance of non-discrimination.
	5	**Sanctions** In the event that the Contractor fails to satisfy the requirements of this specification, the Employer may apply sanctions which include the rejection of claims for payment as being incomplete or the withholding of completion certificates (interim or final).

C3.5.2.2 Construction Programme (GCC Clause 5.6)

For the purpose of this clause, "construction programme" means the Programme of the Works to be submitted in terms of Clause 5.6 of the Conditions of Contract and used to plan and organise the work. In terms of the GCC the accepted programme is a key resource for effective decision making in the contract regarding rights and responsibilities and the basis of adjudication of claims. Due to the contractual role fulfilled by the accepted programme, failure by the Contractor to submit a suitable programme, to pursue approval and to keep the programme up to date may prejudice the Contractor's prospects of defending his obligations or enforcing his rights under the contract.

On award of the Contract, the successful Contractor is to prepare a detailed construction programme covering the duration of the project. The programme is to show the dates by which access, permissions and information from other parties is required and should show all activities (including temporary and permanent works) the inter-dependencies been activities and must highlight which are critical path activities. With reference to Clause 5.6.1 the Initial Programme must be provided prior to commencement of the works. Adjusted programmes of works may be required from time to time as stated in Clause 5.6.1.

In addition to the Construction programme, when directed, the Contractor shall promptly furnish a detailed sub-programme of the construction programme for particular sections of the Permanent Work

C3.5.2.3 Software Application for Programming

The construction programme shall be prepared using Excel Format (*.xls/.xlsx) or MS Projects Format (*.mpp) and showing at least the minimum detail as described in Clause 5.6.2 of the General Conditions of Contract 2010.

C3.5.3 Sequence of the works

The Contractor can choose his own sequence of construction, bearing in mind the availability of water for the pressure testing of pipelines and the water-tightness testing of the elevated tank.

The Contractor must practice progressive reinstatement and remediation in line with the Particular Specification for Environmental Management and EMP. Finishing and tidying must not be deferred to the end of the Contract. All finishing and tidying shall be carried out to the best advantage of the project as a whole, and in close co-operation with other parties and residents.

On no account will spoil, rubble, materials, equipment or unfinished operations be allowed to accumulate in such a manner as to unnecessarily impede the activities of others or impact on the environment. In the event of this occurring, the Employer shall have the right to withhold payment for as long as may be necessary in respect of the relevant Works in the areas concerned without prejudicing the rights of others to institute claims against the Contractor on the grounds of unnecessary obstruction

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C3.5.4 Community Liaison Officer

The Employer will identify a person to be employed by the Contractor as Community Liaison Officer (CLO) for the duration of the Contract. The CLO shall be employed on a full day basis, for the duration of the contract and shall be paid at a rate of 200% of the Civil Engineering Industry minimum wage rate. In addition, all statutory conditions of employment in respect of UIF, Workmen's Compensation etc. shall be met. An amount is provided in the BOQ for the remuneration of the CLO by the Contractor.

The CLO will be required to work under the direction of the Client's ISD officer.

The primary role of the CLO will be liaison and facilitation of communication which shall include *inter alia*:

- Assist in all aspects related to the recruitment of local labour, and advise them of their rights
- Act as liaison between the Contractor and community on the application of Labour-Intensive Construction Methods as set out in this document
- Act as a source of information for the community and the Ward Councillors on issues related to the Contract
- Liaise with a Project Committee, as anticipated in the EMP, for community representation
- Keep the Contractor advised on community issues
- Keep the Contractor advised on any issues pertaining to local security (where applicable)
- Assist in setting up any meetings/negotiations with affected parties
- Keep a diary and record details of labour/community issues that may arise
- Monitor and report on general Health and Safety issues on site
- Assist in HIV & AIDS awareness programmes
- Attend contract site meetings and report on labour/community issues

The CLO shall have no authority to issues any instructions to the Contractor. The CLO shall be neutral to all parties and endeavour to remain impartial should any conflict arise.

Responsibility for identifying a pool of suitable labour shall rest with the CLO, although the Contractor shall have the right to choose from the pool. The Contractor (and subcontractors) shall have the right to determine the total number of labourers required at any one time, which may vary throughout the contract.

The Contractor shall have the right to replace labour that is not performing adequately, and the replacement of any labourer shall be done in conjunction with the CLO.

Local labour employed on the contract shall be paid in accordance with the local labour rate and all statutory conditions of employment shall be met.

C3.5.5 Methods & Procedures

C3.5.5.1 Management & Disposal of Water (Read with SANS 1921 - 1: 2004 clause 4.6)

The Contractor shall pay special attention to the management and disposal of water and stormwater on the site. It is essential that all completed works or parts thereof are kept dry and properly drained. Discharge of water onto landowner property or onto roads that may lead to nuisance or damage shall not be acceptable. Claims for delay and for repair of damage caused to the works as a result of the Contractor's failure to properly manage rain and surface water, will not be considered.

C3.5.5.2 Disposal of Spoil or Surplus Material (Read with SANS 1921 - 1: 2004 clause 4.10)

The Contractor will be responsible for the disposal of material and making all arrangements in connection therewith. The Contractor shall dispose of all surplus and unsuitable excavated material in designated spoil areas.

C3.5.5.3 Length of Trenches not Backfilled and not Rehabilitated

The recommended maximum length of open trenches at any one time is 500 m in order to limit the safety risk to surrounding communities.

In areas immediately adjoined by residential properties the Contractor will not be permitted to excavate any new pipe trenches once the maximum limit for open trench in a particular area has been reached, without the permission of the Environmental Control Officer. A maximum of three working fronts for pipelaying will be permitted.

C3.5.5.4 Length of Pipeline not Pressure Tested

The maximum length of pipeline which is not pressure tested that will be allowed at any given time during construction is 2000 m. The Contractor will not be permitted to excavate any new pipe trenches once the maximum limit for "un-pressure tested" pipeline has been reached unless otherwise authorised by the Employer's Agent.

C3.5.5.5 Determination of Haul distances

The Contractor shall be responsible to plan his work and logistics so as to minimise his costs of haul of imported materials and spoil. No payment will be made for overhaul on this contract unless provision is made for in specific items.

C3.5.6 Quality Plans and Control

The Contractor will be solely responsible for the production of work that complies with the Specifications to the satisfaction of the Employer's Agent. To this end it will be the full responsibility of the Contractor to institute an appropriate Quality Assurance (QA) system on site. The Employer's Agent will audit the Contractor's quality assurance (QA) system on a regular basis to verify that adequate independent checks and tests are being carried out and to ensure that the Contractor's own control is sufficient to identify any possible quality problems which could cause a delay or failure. Any shortcomings in the quality control process shall be rectified timeously and shall be a precondition for the further approval of the affected work.

The Contractor shall ensure that efficient supervisory staff, the required transport, instruments, equipment and tools are available to control the quality of his own workmanship in accordance with his QA-system. His attention is drawn to the fact that it is not the duty of the Employer's Agent or the Employer's Agent representative to act as foreman or surveyor.

C3.5.7 Management of the Environment

(Read with SANS 1921-1: 2004 clause 4.19 and the Environment Particular Specification (PZ) and the applicable Environmental Management Programme (EMPr).

The maintenance in good condition of the environment on the site at all times to the extent reasonably possible and the rehabilitation of the site according to the EMPr is the responsibility of the Contractor and all activities in this regard shall be deemed to be included in the Contractor's rates with the exception of the activities covered by payment items in Clause PZ8 and those activities listed under the scope of the Environmental Rehabilitation specialist sub-contractor.

Nonetheless the overall responsibility to comply with the Environmental Specification and EMPr shall be that of the Contractor, and nothing shall relieve him of this responsibility unless so stated explicitly in the contract or in authorised correspondence pursuant to the contract administration. The Contractor is alerted to the existence of statute law regulating the integrity of the environment, and that sanctions for non-compliance apply under statute law in addition to the sanctions contained in this contract.

The Contractor shall pay special attention to the following:

(a) Clearing of Vegetation

The Contractor shall not destroy, remove or clear trees, timber or shrub to any extent greater than that approved. The Contractor shall not carry out any activity outside the areas defined for clearing unless otherwise approved by the Environmental Control Officer. Organic matter removed may not be disposed of without a waste disposal licence.

(b) Soil Erosion

The quality of topsoil in stockpiles will be maintained by measures including contamination from other materials, minimizing stockpiling periods and prevention of soil erosion by surface runoff or wind. Monitoring for erosion and soil erosion risk will be undertaken regularly to ensure that any erosion that occurs is mitigated as soon as possible.

(c) Risk of Faunal Injury and Death

The trenches will be kept open for the minimum period necessary to undertake the works. Temporary fencing or barriers will be placed along the trenches in all populated areas and in areas that are likely to be used as crossing points along the corridor.

(d) Pollution Prevention

With particular regard to Sanitation, Solid Waste Facilities, Fuels, Hazardous Substances and other Liquid Pollutants as elaborated in the Particular Specification for Environmental Management.

(e) Rehabilitation

The contract provides for the final environmental rehabilitation to be performed by a specialist sub-contractor to the main Contractor, according to a defined scope and the cost thereof is provided for in a provisional sum. The Contractor is alerted however to the contractual requirement for progressive reinstatement throughout the course of the contract and the main Contractor shall bear the overall and final responsibility to ensure that the site and its surrounds are rehabilitated to the condition in which they were prior to commencement of construction activities and in accordance with the EMPr attached hereto.

(f) Working in watercourses

Working in watercourses is strictly controlled by the Environmental Specification and EMPr and sanctions apply to non-conformances. Cofferdams shall be constructed around trenched areas in watercourses using sealed plastic bags filled with sand and means of conveyance must be provided for the flow of water to bypass the excavation. The flow of rivers is not to be restricted.

C3.5.8 Accommodation of Traffic on public roads occupied by the Contractor (Read with SANS 1921 – 1: 2004 clause 4.13 and SANS 1921 – 2: 2004)

C3.5.8.1 General

The Contractor will be responsible for the safe and easy passage of public traffic past and on sections of roads of which he has occupation or where work has to be done near traffic.

Accommodation of traffic, where applicable shall comply with SANS 1921-2: 2004: Construction and Management Requirements for Works Contracts, Part 2: Accommodation of Traffic on Public Roads occupied by the Contractor. The Contractor shall obtain this specification from Standards South Africa if accommodation of traffic will be involved on any part of the construction works.

C3.5.8.2 Basic Requirements

The travelling public shall have the right of way on public roads, and the Contractor shall make use of approved methods to control the movement of his equipment and vehicles so as not to constitute a hazard on the road.

The Contractor shall ensure that all road signs, barricades, delineators, flagmen and speed controls are effective, and that courtesy is extended to the public at all times.

Failure to maintain road signs, warning signs or flicker lights, etc, in a good condition shall constitute ample reason for the Employer's Agent to suspend the work until the road signs, etc, have been repaired to his satisfaction.

The Contractor may not commence constructional activities affecting existing roads before adequate provision has been made to accommodate traffic in accordance with the requirements of this document and the South African Road Traffic Signs Manual.

The Contractor shall design, construct and maintain all temporary access and haul roads to the various working areas. The Contractor shall construct and maintain all temporary drainage works necessary for temporary deviations.

The Contractor shall provide and grant access to persons whose properties fall within or adjoin the area in which he is working.

C3.5.8.3 Traffic Safety Officer

Where warranted by traffic conditions on or near the site, the Contractor shall nominate a suitable member of his staff as traffic safety officer to be responsible for the arrangement and maintenance of all the measures for the accommodation of traffic for the duration of the project. Duties of the traffic safety officer shall be as set out in SANS 1921 Part 2 and shall also be in compliance with the Occupational Health and Safety Act No 85 of 1993 and the Construction Regulations 2003, including the Particular Safety Specification.

C3.5.9 Other Contractors on Site

The Employer may permit other contractors employed on its other projects to draw pipe stock from the pipe yards in use under this contract. The Contractor shall accord such other contractors' opportunity at reasonable times, during working hours, and following notice of not less than two working days, to access the pipe yards for the purpose of uplifting pipes. The Contractor shall record such activities by others and shall obtain signatures against any materials withdrawn or damages or loss caused to the Employer's or Contractor's property.

Any damages or loss alleged to have been caused by activities by other parties so authorised on the site shall not be recognised unless the Employer's Agent is notified timeously and with supporting documentary or photographic evidence.

C3.5.10 Accredited Skills Training

Apart from the Contractor's own in-task training of his workforce it is the intention of the Employer that Accredited Skills Training will also be provided under this contract. The training may be conducted on site or at a remote training venue, at the Employer's discretion. The Employer may elect to specify on-site training. Therefore, the Contractor will be required to provide office space and associated water and sanitation facilities for training as well as construction materials for practical training.

The Employer will notify the Contractor in writing of the name and details of an Accredited Skills Training Facilitator to be appointed by the Contractor. The Training Facilitator will conduct the training, which will take place adjacent to the worksite in a suitable area to be provided by the Contractor for the purpose of training and set aside for that purpose.

It is intended that Skills Training will be provided in any or all of the following disciplines:

- Trench Excavation and Supervision;
- Pipelaying;
- Steel Fixing;
- Formwork and Concreting;
- Basic Construction Hand;
- Bricklaying and block laying;
- Finishing Hand;
- Task Based Labour Administration
- Understanding the Scope of Works and Specifications;
- Labour Recruitment and Management;
- Contractor's Responsibilities and Requirements;
- Payroll Management and Implementation;
- Basic Tender and Contract Pricing

Candidates for Skills Training will be identified from individuals who have a minimum schooling level of Grade 10, preferably Grade 12. Training may also be identified for those that are undergoing, or who have undergone, training at a University of Technology or FET College.

The Employer will notify the Contractor in writing of the names of candidates to be accepted for Accredited Skills Training. The Contractor shall employ such candidates according to his full and normal conditions of employment for unskilled labour for the duration of training.

Upon completion of the training the employment of the trainees shall terminate and the Contractor shall not be obliged to keep the trained personnel in his employ. However he may re-employ candidates on an individual basis by mutual agreement.

The Contractor shall also pay the fees and charges of the accredited trainer according to the agreed scale.

The Accredited On-Site Skills Training is further described in Particular Specification PT. The cost of Accredited On-Site Training is an item in the Bill of Quantities and the cost is to be reclaimed by the Contractor via the Payment Certificates. The item shall be deemed to cover all the Contractor's costs in relation to provision of training as outlined in this section and in Particular Specification PT

C3.5.11 Testing, Completion, Commissioning and Correction of Defects

C3.5.11.1 Process control

The Contractor shall arrange for all tests required for process control to be done by a laboratory acceptable to and approved by the Employer's Agent.

The Contractor may establish his own laboratory on site or he may employ the services of an independent commercial laboratory. Whatever method is used, the Contractor must submit the results of tests carried out on materials and workmanship when submitting work for acceptance by the Employer's Agent. The costs for these tests shall be deemed to be included in the relevant rates and no additional payment will be made for testing as required.

C3.5.11.2 Acceptance control

The process control test results submitted by the Contractor for approval of materials and workmanship may be used by the Employer's Agent for acceptance control. However, before accepting any work, the Employer's Agent may have further control tests carried out by a laboratory of his choice. The cost of such additional tests will be paid for in the contract, but tests that failed to confirm compliance with the specifications, will be for the account of the Contractor.

C3.5.12 Recording of weather

The Contractor shall be permitted to take his own rainfall measurements on site subject to the

Employer's Agent approval, but access to the measuring gauge(s) shall be under the Employer's Agent's control. The Contractor is to provide and install all the necessary equipment for accurately measuring the rainfall as well as to provide, erect and maintain a security fence plus gate, padlock and keys at each measuring station, all at his own cost.

C3.5.13 Key Personnel

The Contractor's Key Personnel for this contract shall be the Contracts Director, Construction Manager, Contracts Site Agent, Health & Safety Officer.

C3.5.14 Management meetings

The Contractor and such other persons as may be nominated by the Employer's Agent shall be required to attend periodic site meetings, the date and place for which will be set by the Employer's Agent in consultation with the Employer and Contractor.

The main purpose of the site meetings will be to review and discuss progress and programme, and all persons attending the site meetings must be empowered to act on behalf of the organisations they represent.

C3.5.15 Forms for Correct Administration

C3.5.15.1 Report on Employment Generation

The Contractor shall provide to the Employer's Agent, monthly, in a form approved by the Employer, a detailed breakdown of his personnel days worked, and those of any Subcontractors currently employed at the Site to conform with EPWP reporting requirements.

The breakdown shall also include details of the following:

- employee name and ID number
- gender and age group
- job category, with skill classification, or speciality.
- job title.
- number of employees in each job category or with that job title.
- trainees in each job category.
- classification of employees by origin (local/imported)

C3.5.17 Daily Records

The Contractor is to provide a triplicate site diary book, which is to be kept on site, for the purpose of keeping daily records in respect of work performed on the site and all significant events. The Employer's Agent Representative will keep the top copy on his records and the Contractor will take the middle copy and the third copy will remain in the site diary book which will be kept on site for the duration of the Contract.

C3.5.18 Bonds and Guarantees

Requirements for a Performance Bond are indicated in section T.2. The original bond document will be retained by the Employer and will be released in accordance with Clause 6.2 of GCC 2015.

C3.5.19 Payment Certificates

The Contractor shall submit invoices at monthly intervals in terms of Clause 6.10.1 of GCC2015 in respect of works completed during the preceding period and materials on site. The work shall be measured according to the format of the BoQ and measurements should be taken together with the Employer's Agent Representative and are subject to agreement as to the status of work completed. The Contractor will submit his invoice, together with invoices and other supporting documentation to the Employer's Agent in terms of Clause 6.10.2. The Employer's Agent will process the Contractor's invoice within 7 days of receipt (refer Clauses 6.10.3 & 6.10.4 of GCC) to produce a Payment Certificate and will deliver this to the Employer.

The Payment Certificate will be scrutinised by the Employer prior to payment within 28 days of receipt of the Certificate from the Employer's Agent, provided that the date of submission is such as to comply with the Employer's payment cycle as notified to the Contractor. The Contractor must ensure that, allowing for the time allowed for processing Certificates by the Employer's Agent, his invoice is submitted in good time to allow for the payment cycle to be met.

The Contractor's tendered rates for the relevant items in the Bill of Quantities shall include full compensation for all possible additional costs which may arise from this, and no claims for extra payment due to inconvenience as a result of the modus operandi will be considered.

C3.5.20 Permits

The Employer requires no special permits for the Contractor's personnel other than those required by the statutory authorities. This includes, but is not necessarily limited to, Work and Residence permits for non-South African nationals, Blasting Certificate for the use of explosives and permits from the Department of Energy and Mineral Affairs in respect of mining and exploitation of natural resources including sand and aggregates.

C3.5.21 Proof of Compliance with the Law

The Contractor is referred to the Returnable Schedules in Section T.2. The Contractor shall be required to maintain evidence of the continued validity of all aspects to which he has witnessed compliance at the time of submission of his tender, as well as any permits required by nature of his operation. The Contractor will be deemed to have granted the Employer the right of inspection of such documentation in the possession of the Contractor at any time as well as to make his own independent investigations where necessary.

C3.5.22 Insurance Provided by the Employer

The Employer is not providing Principal Controlled Insurance for the works that are the subject of this contract.

C3.5.23 Health and safety

C3.5.23.1 Health and safety requirements and procedures

C3.5.23.1.1 General statement

It is a requirement of this contract that the Contractor shall provide a safe and healthy working environment and to direct all his activities in such a manner that his employees and any other persons, who may be directly affected by his activities, are not exposed to hazards to their health and safety. To this end the Contractor shall assume full responsibility to conform to all the provisions of the Occupational Health and Safety Act No 85 and Amendment Act No 181 of 1993, and the OHSA 1993 Construction Regulations 2014 issued on 07 February 2014 by the Department of Labour.

For the purpose of this contract the Contractor is required to confirm his status as mandatory and employer in his own right for the execution of the contract by entering into an agreement with the Employer in terms of the Occupational Health and Safety Act by executing the Agreement form C1.5 included in Section C1: Agreements and Contract Data.

C3.5.23.1.2 Health and Safety Specifications and Plans to be submitted at tender stage

(a) Employer's Health and Safety Specification

The Employer's Health and Safety Specification is included in this document as part of the Particular Specifications.

Contractors are to take note of the aspects identified in the specification requiring attention in the pricing of the tender and in the preparation of the H&S Plan:

(b) Contractor's Health and Safety Plan

The successful Tenderer shall, on receipt of notification that he has been awarded the contract, submit without delay his own documented Health and Safety Plan for the execution of the work under the contract. His Health and Safety Plan must at least cover the following:

(i) a proper risk assessment of the works, risk items, work methods and procedures in terms of Regulations 9 to 30.

(ii) pro-active identification of potential hazards and unsafe working conditions.

(iii) provision of a safe working environment and equipment.

(iv) statements of methods to ensure the health and safety of subcontractors, employees and visitors to the site, including safety training in hazards and risk areas (Regulation 7);

(v) monitoring health and safety on the site of works on a regular basis and keeping of records and registers as provided for in the Construction Regulations.

(vi) details of the Construction Supervisor, the Construction Safety Officers and other competent persons he intends to appoint for the construction works in terms of Regulation 8 and other applicable regulations; and

(vii) details of methods to ensure that his Health and Safety Plan is carried out effectively in accordance with the Construction Regulations 2014.

The Contractor's Health and Safety Plan must take into account the residential nature of the surrounding area and particularly the presence of children.

The Contractor's Health and Safety Plan will be subject to approval by the Employer, or amendment, if necessary, before commencement of construction work. The Contractor will not be allowed to commence work, or his work will be suspended if he had already commenced work, before he has obtained the Employer's written approval of his Health and Safety Plan.

Time lost due to delayed commencement or suspension of the work as a result of the Contractor's failure to obtain approval for his safety plan, shall not be used as a reason to claim for extension of time or standing time and related costs.

C3.5.23.1.3 Cost of compliance with the OHSA Construction Regulations

The rates and prices tendered by the Contractor shall be deemed to include all costs for conforming to the requirements of the Act, the Construction Regulations and the Employer's Health and Safety Specification as applicable to this contract. Should the Contractor fail to comply with the provisions of the Construction Regulations, he will be liable for penalties as provided in the Construction Regulations and in the Employer's Health and Safety Specification.

Items that may qualify for remuneration will be specified in the Safety Specifications included or in the Project specifications.

C3.5.23.2 Protection of the Public

The Contractor is alerted to the fact that the construction site traverses commercial and residential communities. The Contractor in all his planning is to take account of the potential hazard to residents, particularly children and is to take every precaution to avoid injury.

The site office area, pipe yards, the working strip and all other construction zones shall be fenced off to prevent unauthorized entry to the site. Gates shall be provided by the Contractor as required for construction access purposes. The Contractor shall be held responsible for the control of access at these gates at all times as well as to the worksite during removal and re-erection of fencing.

In populated areas and where directed by the Employer's Agent the Contractor shall also supply, install and maintain temporary fencing on both sides of the working area (servitude) and around the perimeter of all agreed additional working areas during construction for prevention of unauthorised access and shall remove on completion of the works.

C3.5.23.3 Barricades and Lighting

Requirements for barricading and lighting are stated Clause 4.18.2 of the Contract Data (section C3.5.1.3, to be read in accordance with in SANS 1921-1 Clause 4.18.2) as well as under the applicable Standard Specifications for each construction activity as modified in the Project Specifications (section C3.7).

C3.5.24 Aids awareness

C3.5.24.1 Service Provider

The Contractor shall engage a qualified service provider (i.e. one that appears on the list of recommended service providers, which is available from all regional offices of the Department of Public Works) to conduct an HIV & AIDS Awareness programme.

The HIV & AIDS awareness programme is to be repeated at 6 monthly intervals for the duration of the Contract (including the initial one at the start of the Contract).

C3.5.24.2 Sanctions

In the event that the contractor fails to satisfy the requirements of this specification, the employer may apply sanctions which include the rejection of claims for payment as being incomplete or the withholding of completion certificates (interim or final).

C3.6: STANDARD SPECIFICATION

C3.6 Standard Specifications

C3.6.1 Introduction

The Standard Specification gives a general description of the requirements to be met, and sets out the relevant specifications relevant to the Contract as well as other relevant and additional clauses. In certain clauses the standard specifications allow a choice to be specified in the project specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in the project specifications.

C3.6.2 General

All materials, and components used in the manufacture and fabrication of plant to be supplied under this Contract, shall be the best quality and suitable for the purposes for which they are intended.

C3.6.3 Quality Management

C3.6.3.1 Applicable Quality Assurance Standards

The Tenderer shall provide a co-ordinated and formally documented statement of his quality management system, including quality management objectives, policies, organisation and procedures, for the compulsory implementation of SABS 0157 Code of Practice for Quality Management Systems, Part III. The same applies to Part II of the said Code of Practice which must be implemented on certain selected items only. However, although Part II will not be implemented in all instances it will not exempt the Contractor of compliance with the quality requirements laid down in the tender documents. Monitoring and control by the Employer's Agent may be done at any time on any material.

The Contractor shall submit with his tender an assessment report on his quality management and quality control system issued by an independent Quality Assurance Authority approved by the Employer's Agent. The inspection on which this assessment report is based shall have taken place not more than 12 months prior to the closing date for this tender.

Responsibility for and all associated costs of compliance with this sub-clause shall rest with the Contractor.

C3.6.3.2 Quality Assurance Enhancement

Should the Contractor or any of the proposed sub-contractors not comply with Sub-Clause C3.6.3.1 at the time of tender, a Contract may be awarded subject to a written undertaking to enhance his own and/or Sub-Contractor's quality assurance system to the satisfaction of the Employer's Agent before commencement of the contract.

C3.6.3.3 Quality Assurance Staff

The Contractor shall satisfy the Employer's Agent that a quality specialist together with sufficient and suitably qualified staff will be assigned to control the quality of the material used by each subcontractor engaged in the supply of critical and major components and sub-assemblies.

C3.6.3.4 Employer's Agent Quality Assurance Representative/Inspector

The Employer's Agent may elect to appoint an independent quality assurance representative to act in a surveillance capacity on his behalf for part or all of the contract.

The Employer's Agent's Quality Assurance Representative will be a selected Sub-Contractor and will be paid by the Contractor under this Contract for all tests passed by the Inspector and certified by the Employer's Agent. The Inspector will not act as the quality controller for the Contractor or his Sub-Contractors and accordingly any tests failing inspection will be for the account of the Contractor. Similarly the costs of all inspections arising following any failed tests will be for the account of the Contractor

.

C3.6.3.5 Classification of Material

Part II of the above-mentioned Code of Practice, i.e. a quality system for manufacture and installatio apply only to certain critical material, products and services if and where indicated hereunder i document.

C3.6.3.6 Sub-Letting

All enquiries made and contracts placed by the Contractor for critical components shall require tha contractors comply with the requirements of the preceding sub-clauses. Responsibility for a associated costs of compliance shall rest with the Contractor. In instances where SABS 0157 applicable, Tenderers must indicate what equivalent alternative Code of Practice is being implement

C3.6.3.7 Disqualification

Tenderers who do not include the formally documented statements called for in Sub-Clause C3.6.2 who do not respond in terms of Sub-Clause C3.6.2.2 above may be disqualified.

C3.6.4 Standard Specifications

C3.6.4.1 Standardised Specifications

The following standard specifications shall apply:

A 1986 - GENERAL

AB 1986 - ENGINEER'S OFFICE
C **1982 - SITE CLEARANCE**
D **1988 - EARTHWORKS**
DB 1989 - EARTHWORKS (Pipe Trenches)

DK 1996 - GABIONS and PITCHING

DM 1981 - EARTHWORKS

GA 1982 - CONCRETE (Small Works)

HA 1990 - STRUCTURAL STEELWORK (Sundry Items)

HC 1988 - CORROSION PROTECTION OF STRUCTURAL STEELWORK

L **1983 - MEDIUM PRESSURE PIPELINES**
LB 1983 - BEDDING (Pipes)

M **1996 - ROADS (General)**
MF 1981 - BASE

(Note 1 - "SABS" has been changed to "SANS, without change to the contents of the specifications).

Preface on Interim Situation until Full Suite of SANS Series Specifications are Available

The Bill of Quantities is based on the SABS 1200 system of specifications and measurement.

Where SANS specifications are available, these have been incorporated into the "Contract" section of this document.

Where overlapping specifications from the SANS 2001 series of specifications occur the appropriate SABS 1200 specifications have been incorporated into the Project Specifications.

In such cases, the requirements of the SABS 1200 specifications shall prevail over the requirements of the SANS specification(s).

The payment clauses in the Bill of Quantities are based on the SABS 1200 series of specifications for consistency and the Tenderer is required to ensure that he has priced all of the requirements pertaining to the SABS specifications.

The variations and additions to the standardised specifications (Project Specifications) as well as the Particular Specifications are included as C3.7 and C3.8 respectively. The variations are prefixed PS, and take precedence over the SABS Standardised Specification.

Where the specifications are in conflict with either the variations and additions to standardized specifications or the SABS Standardised Specifications, the particular specifications shall take precedence.

The following SANS specifications are also referred to in this document and the Contractor is advised to obtain them from Standards South Africa (a division of SABS) in Pretoria.

SANS 10396: 2003:	Implementing Preferential Construction Procurement Policies using Targeted Procurement Procedures
SANS 1921-1 (2004):	Construction and Management Requirements for Works Contracts Part 1: General Engineering and Construction Works
SANS 1921-2 (2004):	Construction and Management Requirements for Works Contracts Part 2: Control of Traffic on Public Roads
SANS 1921-6 (2004):	Construction and Management Requirements for Works Contracts Part 6: HIV / AIDS Awareness

The standardised specifications (SABS 1200) must be read in conjunction with the new SANS 1921 family of standards. In case of any discrepancy or conflict between the two, the SABS 1200 specification shall take precedence and shall govern.

Refer also to the Preface on interim situation until full suite of SANS Series of Specifications is available, on the first page of the Project Specification.

The term “project specifications” appearing in any of the SABS 1200 standardised specifications is deemed to be equivalent to the term “scope of work” in SANS Specifications.

C3.7: PROJECT SPECIFICATIONS

C3.7 PROJECT SPECIFICATIONS

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C3.7.1 PSA : GENERAL

(Applicable to SABS 1200 A – 1986)

PSA 3 MATERIALS

PSA 3.1 Quality and Samples

Add to the Sub-Clause:

No used or recycled material may be used in the Works unless expressly authorised by the Employer's Agent.

All materials to be provided under this Contract shall bear the mark of the South African Bureau of Standards wherever such materials are the subject of an SABS standard.

Materials bearing the SABS mark will not be subjected to tests to determine whether they comply with the relevant specifications. The Employer's Agent may in his discretion require any material not bearing such mark to be tested in accordance with the relevant specifications; should he do so the Contractor shall arrange for such tests to be carried out at the Contractor's cost by the South African Bureau of Standards or other approved body. Should the tests prove that any material complies with the Specifications, the Contractor will be reimbursed the value of the testing body's account for carrying out the tests required by the Employer's Agent.

Samples of concrete aggregates are to be delivered to an approved laboratory.

PSA 4 PLANT

PSA 4.1 Silencing of Plant

Delete the words:

" Machinery and Occupational Health and Safety Act 1983 (Act No 6 of 1983)"

And replace with:

"Occupational Health and Safety Act, 1993".

PSA 4.2 Contractor's Office, Stores & Services (Refer SANS 1921-1 Clause 4.14)

Add to the Sub-Clause:

Neither housing nor shelters are available for the Contractor's employees, and the Contractor shall make his own arrangements to house his employees and transport them to site.

The Employer will indicate possible areas for establishment of a site camp(s). It shall be the Contractor’s responsibility to negotiate terms of use with the landowners and land users at the applicable site(s) to enable him to erect his site offices, workshops and storage facilities. The Contractor shall ensure that, in addition to his own requirements, 500 square meters of space is provided within his secured area for skills training purposes. The temporary facilities and ablution facilities shall comply with the requirements of the Local Authority.

On completion of the Works or as soon as the Contractor’s facilities are no longer required the Contractor shall remove such facilities and clear away all surface indications of their presence. The site is to be rehabilitated as described elsewhere

.

PSA 5 CONSTRUCTION

PSA 5.10	**Working Width (new sub-clause)** For the major part of its length, the working strip for the pipelines is deemed to be 10m The working width along the route of the pipeline is reduced to a width less than the deemed width in certain areas due to the proximity of buildings, other structures, road reserve restrictions, etc. Such restricted working areas have been designated as 'restricted width' and relevant items are included in the Bill of Quantities. In all areas of restricted working width the Contractor shall take all additional precautions as necessary and as required in terms of the applicable regulations for the protection of adjacent structures, avoidance of intrusion into streams and other designated areas for protection, including shoring where necessary, and shall adopt such working methods as are necessary to achieve the completion of all the stages of the works, safely and without undue nuisance, within such reduced working width.
PSA 6	**TOLERANCES**
PSA 6.2	**Degrees of Accuracy** Add to the Sub-Clause: Generally, Degree of Accuracy II shall be applicable to the whole of the Works, unless specified otherwise (refer specifically to PSD 6 and PSG 6).
PSA 7	**TESTING**
PSA 7.2	**Approved Laboratories** Add to the Sub-Clause: "The Contractor shall establish a testing laboratory equipped in such manner that it may be deemed by the Employer's Agent to be an approved laboratory. Alternatively, he may use the services of an established testing laboratory which the Employer's Agent has approved. The Employer's Agent shall be given free access to the testing laboratory."
PSA 8	**MEASUREMENT AND PAYMENT**
PSA 8.2.1	**Fixed-Charge and Value-Related Items** Add to the Sub-Clause: The amount, if any, by which the sum of the fixed-charge and value-related items exceeds three percent of the net total tendered amount (excluding allowances for contingencies and price

	escalation) shall be regarded for payment purposes as time-related items and will be paid in accordance with Clause 8.2.2. (refer to Clause C2.1 (e) of the Pricing Instructions)
PSA 8.2.2	**Time-related Items** (refer to Clause C2.1 (e) of the Pricing Instructions) Re-word the third and fourth lines to read: "incremental amounts (calculated by the division of the remainder of the tendered sum by the number of remaining months of the duration of construction as assessed by the Employer's Agent) will be" Add to the Sub-Clause: Notwithstanding the provisions of Sub-Clause 8.2.2, an approved extension of time will not qualify the Contractor to receive any payment for that portion of fixed charge and value-related items which has become regarded as "time-related" items in terms of PSA 8.2.1 above.

PSA 8.4.2.2 Temporary Works – Dealing with Water on Works

Add to the Sub-Clause:

The sum in PSA 8.4.2.2 (h) shall cover the cost of providing, operating and maintaining the necessary equipment and other temporary works for dealing with groundwater in trenches and excavations.

C3.7.2 PSAB: ENGINEER'S OFFICE

(Applicable to SABS 1200 AB - 1986)

PSAB 2 INTERPRETATIONS

PSAB 2.1(b) Supporting Specifications

Delete the Sub-Clause and substitute the following:

SABS 1200 A

PSAB 2.3 Definitions

Delete the first two lines and substitute the following:

For the purposes of this specification the definitions given in SABS 1200 A shall apply:

PSAB 3 MATERIALS

PSAB 3.1 Nameboards

In the 3rd line delete “South African Institution of Civil Engineers” and substitute with “Consulting Engineers South Africa”.

PSAB 3.2 Office Building(s)

Delete the first sentence and substitute the following:

Where required, the Contractor shall supply and furnish one air-conditioned 'Kwikjack' (12 m x 3 m) office for the sole use of the Employer's Agent and his staff. The office is to be erected at the Contractor's offices.

Add to the Sub-Clause:

In addition to the furnishings listed under sub-items (a) to (i), the following shall be provided and properly maintained:

(j) electrical installation is to include a light and one 15A plug point plus an adequately sized air conditioning unit (for heating and cooling) for each room.

(k) one refrigerator of at least 100 litre capacity

(l) one kettle of at least 2 litre capacity

(m) one tea set comprising six cups and saucers, six teaspoons, one teapot, one sugar bowl and one milk jug

(n) covered parking for four vehicles

(o) two "Barhold" or similar wall mounted racks each with 6 clamps suitable for hanging A0 sized drawings

(p) one large meeting table

(q) ten additional chairs

PSAB400 Vehicles for Engineers Staff

The Contractor shall provide, at his own cost, a suitable vehicles for the exclusive use of the Engineer's team for the duration of the Contract. An item has been included under *Preliminary and General (P&G) items* in the Bill of Quantities to cover such costs.

1. Vehicle Type

The vehicle shall be a 4x4 Light Delivery Vehicle (LDV), double cab, with adequate load capacity and ground clearance to access construction and remote project sites.

The vehicle shall be maintained in good working order at all times, and shall comply with all applicable road traffic and licensing requirements in South Africa.

2. Maintenance & Running Costs

The Contractor shall be responsible for all routine and non-routine maintenance of the vehicle, including servicing, tyres, repairs, licensing, and roadworthiness certification.

The Contractor shall cover all reasonable fuel costs, lubricants, consumables, toll fees, and related operational expenses.

3. Insurance

The vehicle shall be comprehensively insured by the Contractor, including third-party liability, passenger liability, theft, and accident cover.

Proof of valid insurance cover shall be submitted to the Engineer prior to mobilisation and kept up to date throughout the Contract period.

4. Availability

The vehicle shall be made available to the Engineer's team for the full duration of the Contract, commencing from the Date of Possession of Site until issuance of the Final Completion Certificate, unless otherwise directed by the Employer.

The vehicle shall be dedicated for the Engineer's use during working hours and project site visits.

5. Replacement & Contingency

In the event of breakdown, accident, or unavailability of the designated vehicle, the Contractor shall immediately provide a replacement vehicle of equivalent or better specification at no additional cost to the Employer.

PSAB 4.2 Survey Equipment (New Sub-Clause)

The Contractor shall provide the following survey equipment on the Site from the commencement to the completion of the Works:

- One 'Total Station'
- One automatic reading Engineer's level plus tripod
- One levelling staff (5 m long, 1 cm graduations)
- One staff angle bubble
- One metal change-point for levelling
- One separate plumb-bob
- One spirit level (one metre long)
- One hammer (2 kg) with steel or wooden pegs as necessary
- Two 50 m steel tape
- Three 5,0 m (or longer) retractable steel tape

The 'Total Station' may be shared by arrangement between the Contractor and the Employer's

Agent or his representative on Site. All other survey equipment shall be for the sole use of the

Employer's Agent Representative and his staff. The Contractor shall keep the equipment continuously insured against any loss, damage, or breakage and he shall indemnify the
Employer's Agent and the Employer against any claims in this regard. Upon completion of the Works the survey equipment as listed above shall revert to the Contractor.

The Contractor shall maintain the equipment in good working order and keep it clean until the completion of the Works.

PSAB 4.500 COMPUTER EQUIPMENT & CELLULAR PHONES (New Sub-Clause)

The Contractor shall provide the following for the Engineers Staff:

1. 2X Laptops, The laptops shall be an Intel Core i7 (12th Gen or higher) with a minimum of 8 cores, 16 GB DDR4/DDR5 RAM, 512 GB SSD storage, a 15.6" Full HD display, integrated Intel Iris Xe or equivalent graphics, Wi-Fi 6, Bluetooth 5.1, and Windows 11 Pro complete with 3G potable modern with for internet connection contract for the duration of the project
2. Insta 360 X5 6mm 360 Degree Camera complete with Matterport or insta360 1TB plan for the duration of the contract
3. A3 and A4 wireless printer with scanning feature
4. 2x Samsung Galaxy S24 or iPhone 15 Pro Max or Similar,

The Contractor shall keep this equipment continuously and comprehensively insured and shall indemnify the Employer and the Employer's Agent against any claims in this regard. The Contractor shall maintain this equipment in good working order until the completion of the Works, whereupon ownership of said hardware and software shall revert to the Employer.

PSAB 5 CONSTRUCTION

PSAB 5.2 Engineer's Office (Refer SANS 1921-1 Clause 4.14)

Add to the Sub-Clause:

The toilet facilities provided for the sole use of the Employer's Agent or his representative(s) shall inc hygienic and sanitary condition and shall be removed on completion of the Works. The facilities pro requirements as applicable and the Contractor shall pay all sanitary fees and charges.

Survey Assistants

Delete the first sentence and substitute the following :

The Contractor shall make available to the Employer's Agent two suitably trained labourers for use on and about the Agent at all reasonable times.

Computer Equipment (New sub-clause)

Add new sub-clause:

The Contractor shall ensure that adequate supplies of consumables (paper and ink cartridges) are available on site at all times. The amounts paid by the Contractor will be recoverable from the Employer – a Provisional Sum has been included in the Bill of Quantities to cover these costs.

C3.7.4 PSD : EARTHWORKS

(Applicable to SABS 1200 D - 1990)

PSD 3 MATERIALS

PSD 3.2.1 Material suitable for Embankments and Terraces

Embankment material shall be compacted to 90% modified AASHTO density.

PSD 4 PLANT

Add the following new Sub-Clauses:

PSD 4.5 Restriction on use of Plant (New Sub-Clause)

Where the Contractor finds it impractical to use mechanical plant for excavation or to complete portions of the work due to restrictions caused by difficult access or the presence of existing structures, pipelines or services shown on tender drawings, the Contractor will be deemed to have satisfied himself as to the alternative requirements when entering rates against the appropriate items in the Bill of Quantities as no claim for extra payment based on the inability to use plant in such circumstances will be considered.

PSD 4.6 Vibration loadings from use of Plant (New Sub-Clause)

The onus will be on the Contractor, when proposing to use heavy plant or equipment to complete work in close proximity to a existing structures, pipelines or services, to determine the effect of the vibration loading from the plant or equipment on the supporting ground or foundation and the structure, pipeline or service and take all necessary steps to ensure that the stability or integrity of the element concerned is not compromised by the particular selection and use of plant or equipment.

Any damages caused to existing elements directly or indirectly arising out of the use of plant and equipment in close proximity shall be made good, to the satisfaction of the Employer's Agent by the Contractor at his own expense.

PSD 5 CONSTRUCTION

PSD 5.1.1.1 Barricading and Lighting (Refer SANS 1921-1 Clause 4.18.2 and 4.18.3) Delete the Sub-Clause and substitute:

Without limiting any obligation which the Contractor may have in terms of any Act, Ordinance or other legislation, the Contractor shall ensure that all excavations which are accessible to the public or which is adjacent to a public road or thoroughfare, or by which the safety of persons may be endangered are protected as set out in clause 13 of the General Safety Regulations of the Occupational Health and Safety Act, 1993 and that watchmen are employed to ensure that barricades, barriers and lights are effective at all times.

Trench excavations shall be adequately protected by means of fences or barricades so as to enclose the spoil and the excavations, as approved by the Employer's Agent. Fences shall have at least two horizontal double sided 'red/white' chevron tapes approved by the Employer's Agent. The tapes shall be stretched tightly between supports along both sides and ends of the excavation at levels approximately 0,45 m and 1,25 m above the ground. The supports shall consist of poles or iron standards securely planted in solid ground at not more than 10 m centres so as to enclose the spoil and the excavations.

Bridges for vehicles and/or pedestrians shall be provided along the route of the work as and where may be considered necessary by the Employer's Agent. They shall consist of a number of suitably sized steel plates laid across open excavated trenches. They shall be protected on each side by a stout two rail timber safety barrier, at least 1m high, consisting of 150 x 75 mm timber verticals set firmly into the ground, 75 mm x 50 mm rails securely fastened to them. At least 4 lamps or reflective markers must be provided at each crossing.

Where construction is in, or across public roads, barricades or barriers and temporary road signs shall be erected. All such signs and positioning thereof shall comply with the requirements set out in Road Note 13 read in conjunction with the SA Road Traffic Signs Manual.

PSD 5.1.1.2 Safeguarding of Excavations (Refer SANS 1921-1 Clause 4.18.3)

In sub-clause a) delete the words "Machinery and Occupational Safety Act" in the third and forth lines and substitute "regulations to the Occupational Health and Safety Act, 1993"

PSD 5.1.1.3 a) Explosives (New Sub-Clause) (Refer SANS 1921-1 Clause 4.7)

Notwithstanding Sub Clause 5.1.1.3 the Employer's Agent shall be notified at least 48 hours beforehand of the Contractor's intention to use explosives on site.

It shall be incumbent on the Contractor to make himself aware of the restrictions to blasting imposed by electric transmission or telephonic lines and other similar services. Where the presence and location of electric transmission or telephonic lines etc, are known or are shown on the Employer's Agent's drawing at tender stage the Contractor must make allowance in his rates and programmes for restrictions and delays which may result from restrictions imposed by the authorities.

PSD 5.1.1.3b) Use of Explosives (New Sub-Clause) (Refer SANS 1921-1 Clause 4.7)

Generally, the Contractor will be permitted to use explosives for breaking up rock and hard material during excavations, for demolishing existing structures and for such other purposes where it may normally be required, subject to the following conditions:

a) The Employer's Agent or Inspector of Explosives shall have the power to prohibit the use of explosives in cases where in his opinion, the risk of injury or damage to persons, property or adjoining structures is too high. Such action by the Employer's Agent shall not entitle the Contractor to any additional payment for having to resort to other less economical methods of construction unless otherwise provided in the Contract Data or Bill of Quantities.

b) Should blasting be necessary, the Contractor shall take every precaution to protect the Works and persons, animals and property in the vicinity of the site. The Contractor will be held responsible for any injury or damage caused by any blasting operations and shall make good such damage at his own expense.

c) The requirements for the Explosives Regulations Act (Act 26 of 1956) and the requirements of the Inspector of Explosives shall be complied with. In addition, where applicable, the requirements of Chapter 9 of the Regulations published in terms of the Mines and Works Act (Act 27 of 1956) and the requirements of the Government Mining Engineer shall be complied with.

d) A copy of each blasting permit issued to workmen, and of each permit issued to the Contractor to cover the purchase, storage and transport of explosives, shall be handed to the Employer's Agent. The Contractor shall grant the Employer's Agent access to all records maintained for the Inspector of Explosives or the Government Mining Engineer, as the case may be.

e) Before any blasting is undertaken, the Contractor, together with the Employer's Agent shall examine and measure up any buildings, houses or structures in the vicinity of the proposed blasting and establish and record together with the owners thereof the extent of cracking or damage that may exist before commencement of blasting operations. The Contractor shall produce a photographic record of neighbouring structures before blasting commences. These structures will be pointed out by the Employer's Agent. It shall be the responsibility of the Contractor to make good at his own expense any further damage to such houses, buildings or structures which is a result of the blasting.

f) Where there is reasonable danger of damage to power and telephone lines or any other property, the Contractor shall suitably adapt his methods of blasting, the size of the charges and use adequate protective measures such as cover blasting in order to limit the risk of damage as far as possible.

g) When blasting to specified profiles, the Contractor shall so arrange the holes and charges that the resulting exposed surfaces are as sound as the nature of the material permits. The Contractor shall make good at his own expense any additional excavation necessitated by the shattering of rock in excess of any overbreak allowance specified in the Specification Data or in any other specification or given on a drawing.

PSD 5.1.2.2 Detection, Location and Exposure (Refer SANS 1921-1 Clause 4.17)

Add to the Sub-Clause:

All existing services on the site may not be shown on the Drawings or be visible on the site. The Employer's Agent may order excavation by hand in order to search for and expose services. An item has been included in the Bills of Quantities to cover the cost of such work if so ordered by the Employer's Agent.

Where a service is damaged because of the Contractor's negligence, he shall be liable for the costs involved in the repair of the service and any other costs consequent upon the interruption of the damaged services.

PSD 5.1.4.3 Excavated Material Not to Endanger or Interfere (Refer SANS 1921-1 Clause 4.10)

Delete the sentence: "If the necessity .....will be borne by the Employer."

PSD 5.1.6 Road Traffic Control

Delete from the fifth, sixth and seventh lines all words following "stated in the project specification".

An item has been included in the Bills of Quantities to cover the relevant costs.

PSD 5.1.7 Excessive Pollution (New Sub-Clause) (Refer SANS 1921-1 Clause 4.19)

The Contractor shall take all reasonable measures to minimize excessive noise and dust nuisance, pollution of streams and inconvenience to or interference with the public or others because of the execution of the works.

PSD 5.2.2.1 Excavation for General Earthworks and for Structures (Refer SANS 1921-1 Clause 4.10)

Add to the Sub-Clause:

(f) Where outside shuttering is ordered by the Employer's Agent, the excavations shall be carried out for an extra width of not more than 600mm all around the structure, measured from the base of the face to be shuttered, to allow for the shuttering to be fixed, this extra excavation and refilling where necessary is to be measured and paid for under quantities allowed for this purpose in the Schedule. Outside shuttering shall be used for the construction of all major structures unless ordered otherwise by the Employer's Agent.

(g) Where permanent concrete is to be placed against an excavated face, the excavation shall be trimmed to ensure that there is no projection greater than 20mm protruding into the excavation profile.

PSD 5.2.2.3 Disposal

Delete the second sentence and substitute:

"He shall dispose of surplus and unsuitable material in areas approved by the Employer's Agent".

PSD 5.2.3.1 Embankments

In the fourteenth line delete "600mm" and substitute "300mm"

In the seventeenth line delete "300mm" and substitute "150mm"

On the twentieth line delete the sentence starting 'Each layer shall be .... ' and substitute the following:

Each layer shall be compacted to achieve 90% modified AASHTO density except where indicated otherwise on the Drawings.

PSD 5.2.4.2 Topsoiling

Delete the Sub-Clause and substitute:

Where scheduled, topsoil shall be placed on all surfaces and on embankments and shall be lightly compacted by wheeled vehicles or by tamping and trimmed neatly to the required lines grades and levels. The final thickness of topsoil after compaction shall be at least 100mm. Prior

to topsoiling, the surfaces to be topsoiled shall be prepared by pulling horizontal ruts into the soil with the tines of a front-end loader or other suitable method to retard erosion of the topsoil.

PSD 5.2.4.3 Grass or other vegetation

Add to the Sub-Clause:

The surface of topsoiled embankments, terraces and other designated areas are to be planted with fine sturdy approved grass as specified elsewhere. The grassed areas are to be fertilized and watered until the area is fully covered with grass.

PSD 5.2.5.1 FREEHAUL

Delete the Sub-Clause and substitute :

All hauls will be regarded as freehaul. No overhaul will be paid under this contract.

PSD 5.5.5.2 Overhaul

Delete the Sub-Clause.

PSD 6 TOLERANCES

PSD 6.3 Excavation by Mechanical Means (New Sub-Clause)

Where bulk excavation is carried out by earthmoving equipment, such excavation will only be allowed to within a level of 300mm, or less as ordered by the Employer's Agent, above the general level to which the ground has to be reduced, the balance of the bulk excavation being carried out by hand or by other means approved by the Employer's Agent.

PSD 7 TESTING

PSD 7.4 Tests to the Contractors Account (New Sub-Clause)

The Contractor shall make arrangements with a soils testing laboratory to undertake the following tests and to pass the test results to the Employer's Agent. The costs of such tests shall be included in the rates tendered for the appropriate item in the Bills of Quantities.

a) Material imported from outside the Contract Site as working surfaces, subgrade improvement or for fill material

One CBR and indicator test per 200m^3 of compacted material brought on site, (river sand will normally be exempted from this requirement). A sample and one CBR and indicator test of the material proposed for importation shall be submitted to the Employer's Agent for approval prior to the commencement of importation.

b) Fill material in place

One density and moisture content per 100m^3 of compacted fill

c) Compacted subgrade or finished level

One density and moisture content per 200m^2 of compacted surface area.

Should any of the above density tests fail to comply with the specified requirements, the Contractor shall at his own expense remedy the failure and submit a new test to the Employer's Agent.

PSD 7.5 Determination of Compaction (New Sub-Clause)

Determination of the standard of compaction achieved shall be carried out in accordance with Standard methods of testing road construction materials published by the Department of Transport Division of National Roads, Publication TMH.1.

PSD 7.6 Tests at the Employer's Request (New Sub-Clause)

Where CBR, indicator tests and the like are required on materials from within the Contract Site the Contractor shall also make arrangements with a soils testing laboratory to undertake these tests, the costs of which have been allowed for in the Bills of Quantities as a provisional sum. Payment for such tests will be per sample tested and reported to the Employer's Agent.

PSD 8 MEASUREMENT AND PAYMENT

PSD 8.1.1 Basic Principles Delete the first

sentence and substitute:

"The basic principles of measurement and payment for all earthworks are that the rates tendered for excavation shall cover the cost of excavating and re-use of the excavated material in backfilling, forming embankments, etc., including any necessary additional offloading, stockpiling and reloading and the cost of disposal of any".

PSD 8.1.2 Basic Principles

Delete the first line of the first sentence and substitute:

"Excavations which are required to be backfilled, or partially backfilled, will be measured as if taken out"

Delete the fifth and sixth lines and substitute:

"Other such structures, the volume will be measured from the finished outline of the concrete, or the blinding to the concrete (as the case may be), as shown on the Drawings.

PSD 8.3.2 Bulk Excavation

Delete the second sentence and substitute:

"The rate shall cover the cost of complying with all precautions required in terms of 5.1 in addition to the cost of excavation, offloading to stockpile, stockpiling and reloading as may be necessary, spreading or backfilling, compacting and watering"

"Drawing D-1" in the fifth line and in the last line to read "Fig D-1"

PSD 8.3.3 Restricted Excavation

"Drawing D-2" in the first line to read "Fig D-2"

PSD 8.3.4 Importing of Materials

Delete sub-clauses (b) and (c).

Add the following sub-clauses

PSD 8.3.4 (d) for embankment construction

The rate shall cover the cost of royalties (if any) and acquiring suitable material, loading, transporting with freehaul distance, unloading, spreading in layers not exceeding 150mm thick, watering, compacting to 90% Mod AASHTO density, trimming slopes of embankment to required outline all in accordance with the Specifications. The rate shall also include for carrying out density testing and the disposal of any surplus material.

PSD 8.3.4 (e) for backfilling around structures

The rate shall cover the cost of royalties (if any) and acquiring suitable material, loading, transporting with freehaul distance, unloading, spreading in layers not exceeding 150mm thick, watering, compacting to 90% Mod AASHTO density, trimming upper surfaces to the required outline all in accordance with the Specifications.

PSD 8.3.14 Overbreak (New Sub-Clause)

Where hard rock is encountered in bulk or restricted excavations, the Contractor shall be reimbursed for excavation and refilling with concrete Grade 10/40 under the base and for the relevant grade of concrete for the structure walls for an excess of 200mm thickness beyond the scheduled excavation line. If a blinding layer is indicated then the 200mm shall be taken from the uppermost surface of the blinding layer.

No additional items have been provided for reimbursement of any additional excavation, concrete infill and/or formwork over and above the allowance stated. The Contractor is required to make his own estimate of any additional costs he feels may be required and these are to be included in the above-mentioned items. The method of measurement shall be on the basis of the area of rock encountered within the nett outline of the structure only and regardless of actual excavated levels..... ..... Unit m^3

C3.7.5 PSDB : EARTHWORKS (PIPE TRENCHES)

(Applicable to SABS 1200 DB - 1989)

PSDB 2 INTERPRETATIONS

PSDB 2.1 Supporting Specifications

Add New Sub-Clause:

PSDB 2.1.3 Specification for Labour Intensive Methods

SANS 1921 Part 5 shall also apply in the case of labour-based excavation.

PSDB 3 MATERIALS

PSDB 3.1 Classes of Excavation

Add to the Sub-Clause:

The classification of materials in respect of areas designated for hand excavation shall be as per Annex B of SANS 1921 Part B (Tables B.1 & B.2).

PSDB 3.3 Selected Granular Material

Delete the Sub-Clause and substitute:

Selected granular material shall be material of a granular, non-cohesive nature that is singularly graded between 0,6 mm and 10 mm, is free-draining and has a compactibility factor (as determined by the test given in Section LB of Part 3 of SABS 0120) not exceeding 0,4.

(for bedding material (padding) for steel pipes see PSLB 3.3)

PSDB 3.4 Selected Fill Material

Delete the Sub-Clause and substitute:

The category 'Selected Fill Material' shall apply to HDPE piping only. For steel piping all material up to the underside of backfill shall be measured as selected granular. (for bedding material (padding) for steel pipes see PSLB 3.3)

Selected fill material for HDPE piping shall be a sandy clay material having a PI not exceeding 6 and that is free from vegetation and from uncrushable lumps and stones of diameter exceeding 20mm.

PSDB 3.5(a) Backfill Material

In the third line delete "150mm" and substitute "100mm".

PSDB 3.5(b) Backfill Material

In the second line delete “PI not exceeding 12” and substitute “PI not exceeding 6”.

PSDB 3.5(c) Cement Stabilised Backfill (New Sub-Clause)

Where scheduled, or directed by the Employer’s Agent, backfill shall be stabilised with 5% cement by mass. The backfill material shall have a plasticity index not exceeding 10 and all material must pass through a sieve of aperture size not exceeding that specified in SABS 1200 LB, Sub-Clause 3.2, as amended.

The dry materials shall first be mixed in a concrete mixer, whereafter sufficient water is to be added to produce the stiffest consistency available for placing and compacting with vibrators.

PSDB 3.6 Materials for Reinstatement of Roads and Paved Areas

Delete the Sub-Clause and substitute:

Material used in the reinstatement of roadways shall fall into the following relevant categories:

(a) Foundation material recovered from the excavation of trenches across existing roadways which, if so, instructed by the Employer’s Agent, shall be set aside and re-used as subbase material.

(b) New material which shall conform to the requirements of:
  (i) Clause 3.2.1 of SABS 1200 ME for the Subbase
  (ii) Clauses 3.2 and 3.3 of SABS 1200 MF for the Basecourse
  (iii) Clause 3.2.2 of SABS 1200 ME for the Gravel Wearing Course
  (iv) Clause 3 of SABS 1200 MH for the asphalt surfacing

PSDB 3.7 Selection

Delete the second sentence and substitute the following:

The Contractor is not required to use selective methods of excavating but shall, if so instructed by the Employer’s Agent, screen or otherwise treat excavated material in order to produce material suitable for the bedding cradle or the bedding blanket.

PSDB 4 PLANT

PSDB 4.1 Excavation Equipment

In the first line delete "The Contractor" and substitute: "In sections deemed to be excavated by mechanical means, the Contractor" Add to the Sub-Clause:

Should any portion of a pipe trench exceed the specified depth, the Contractor will be held responsible for any additional costs which may arise as a result of such over-excavation. Concrete filling or imported compacted fill may be ordered by the Employer's Agent to be placed below the bottom of the trench.

PSDB 4.3 Compaction Equipment

Add to the Sub-Clause :

In sections designated to be compacted by labour-based methods hand stampers shall be used as per requirements of Clause 4.3 of SANS 1921 Part 5.

PSDB 5 CONSTRUCTION

PSDB 5.1.1 General

Add to the Sub-Clause:

In the case of Labour Intensive Methods, the method of excavation of trenches is subject to determination according to the method described in PSDB 5.4.1.

PSDB 5.1.2.3 Sloping Ground

Delete the Sub-Clause and substitute:

The Contractor shall be responsible throughout the duration of the Contract, inclusive of the Defects Liability Period, for the provision of all soil erosion preventative measures necessary to protect the trenches, pipes and land utilised by the Contractor during the Contract from any adverse effects of soil erosion, settlement, scour, etc., resulting from the construction of the Works.

Cross embankments, generally extending across the full width of the working strip, consisting of low earth mounds shaped to rounded form and so oriented as to have a fall of 1% along their length, shall be constructed with compacted material having a minimum density of 90% modified AASHTO density and minimum dimensions and maximum spacings

dependent on the slope of the ground along the length of the pipeline, as indicated in the following table :

Slope of Ground	Minimum Height	Minimum Base Width	Maximum Spacing
0% - 2%	No cross-embankments required		
2% - 5%	300 mm	1,2 m	55 m
5% - 10%	300 mm	1,2 m	40 m
10% - 15%	375 mm	1,5 m	30 m
Greater than 15%	450 mm	1,7 m	20 m

The height of the cross-embankments for a distance of 1 metre on either side of the trench centreline shall be raised 150mm above the remainder of the cross-embankment to allow for settlement. In order to form a satisfactory drainage channel upstream of each crossembankment (at a slope of 1%) the crown over the backfilled trench shall be removed for a distance of 0,5m upstream of the cross-embankment.

Cross-embankments shall be constructed to the same minimum standards and dimensions indicated above wherever artificial slopes have been formed on the working strip or other areas used during construction and, with the approval of the Employer's Agent, are permitted to be so left.

Payment will be made for the construction of cross-embankments in accordance with SubClause 8.3.4(c), provided construction thereof has been either ordered or approved by the Employer's Agent prior to the commencement of such construction.

PSDB 5.1.2.4 Excavation and Shoring Requirements (New Sub-Clause)

The project will involve excavation in collapsible and unstable material. The Contractor shall make full allowance in their rates for:

- Provision, installation, and maintenance of adequate shoring, bracing, or trench support systems to ensure the safety of personnel and equipment during excavation and pipelaying.
- Ensuring that all trenches are safely supported in accordance with the Occupational Health and Safety Act (OHS Act, 85 of 1993) and relevant Construction Regulations.

- The method of shoring/support shall be appropriate to the soil conditions and depth of trench, and shall be kept in place until backfilling has progressed to a safe level,refer to attached Geotechnical Report for the soil specifications.
- All costs for shoring, trench support, and compliance with safety requirements shall be deemed to be included in the Contractor's unit rates for excavation and pipelaying.
- No separate payment will be made for shoring or trench support.

PSDB 5.2 Minimum Base Widths

Add to the Sub-Clause:

Trench sides shall be as near vertical as possible in order to minimise the quantity of backfill material required and to avoid possible difficulties where pipelines have to be installed parallel to existing services, fences, hedges, etc and to minimise the loading on the pipe.

The base width for trenches for cables, ducts and unbedded flexible continuous piping, of external diameter less than 125mm laid at a depth not exceeding 1,5m, shall be equal to the external diameter of the cable, duct or pipe, plus a side allowance of 300mm on either side.

PSDB 5.4 Excavation

Add to the Sub-Clause:

Where a pipe is to be laid in a vertically sided trench with temporary side support, it is necessary to ensure that the compacted bedding and backfill is hard up against the soil forming the trench side by withdrawing the temporary supports stage by stage as the backfill rises up the trench. Where the pipe trench crosses surfaced roads, the Contractor shall neatly cut two parallel grooves into and through the "black top" before excavating between the grooves. The grooves are to be set back at least 200 mm from the edge of the excavation face to prevent ravelling of the cut edge. The cost of this operation, where not scheduled separately, will be held to be covered in the general rates for excavation.

PSDB 5.5 Trench Bottom

Add to the Sub-Clause:

Where steel pipes are laid in waterlogged conditions and/or where so instructed by the Employer's Agent a 150mm thick layer (See PSLB 5.2.5) of imported single sized stone (19mm size unless otherwise instructed by the Employer's Agent) with a geofabric filter surround ("bidim" Grade A4 or similar approved) shall be constructed under the bedding layer specified for the pipes.

PSDB 5.5.1 Jointing Holes (New Sub-Clause)

Jointing holes shall be cut of sufficient length and depth to allow for the proper making or bolting of pipe joints and to ensure that joint collars or sleeves do not rest on the trench bottoms. After the pipework has been inspected, tested and approved by the Employer's Agent, the jointing holes shall be refilled with selected soft material free from stone and then rammed to provide a continuous uniform support for the pipework. No specific payment will be made for forming and refilling holes, the cost of which is deemed to be included in the tendered rates.

PSDB 5.6.1 Backfilling - General

Add to the Sub-Clause:

Notwithstanding the requirements of Sub-Clauses 5.6.1 and 5.6.6, no pipe joint or pipe fitting shall be covered by either blanket or backfill material prior to the successful completion of the visual inspection and pressure testing of the relevant section of the pipeline.

All backfilling shall be carried out by hand and the Contractor must price his tender accordingly. No mechanical plant shall be used in backfilling without prior written consent of the Employer's Agent.

PSDB 5.6.2 Material for Backfilling

Delete fourth, fifth and sixth lines and substitute the following :

Hard rock material shall not be used for, or incorporated into, the backfill above the bedding layers without the Employer's Agent approval.

PSDB 5.6.3 Disposal of Soft Excavation Material

Add to the Sub-Clause:

Surplus material or unsuitable material shall be disposed of off site by the Contractor.

PSDB 5.6.4 Disposal of Intermediate and Hard Rock Material

Delete the Sub-Clause and substitute:

Surplus intermediate and hard rock material from trench excavations shall be disposed of off site by the Contractor.

PSDB 5.6.8 Transport for Earthworks for Trenches

Delete the Sub-Clause and substitute:

The requirements of Sub-Clause 5.2.5 of SABS 1200 D as amended and as applicable shall apply.

(Refer also PSD 5.2.5.1 & 5.2.5.2)

PSDB 5.7.2 Areas subject to Traffic Loads

Add to the Sub-Clause:

for an extent of 2 m on either side of the carriageway at each crossing.

PSDB 5.9.4 Bitumen Roads: Sub-Base and Base

Add to the sub-clause:

Each Tenderer shall include in his tender allowances to cover the costs of reinstating all surfaces and inclusive of all layers to their conditions pertaining before the commencement of construction.

Items have been included in the Bill of Quantities to cover the reinstatement of certain surfaces (concrete and/or asphalted/gravel driveways and/or roads) and for payment purposes, the area of those specific surfaces shall be calculated from the product of the length of the trench and the specified trench width plus 400 mm (refer PSDB 5.4).

PSDB 8 MEASUREMENT AND PAYMENT

PSDB 8.1.4 Basic Principles

Delete the Sub-Clause and substitute:

Except that the volume will be computed as specified in 8.2.3, the requirements of Sub-Clause 5.2.5.1 (Freehaul) of SABS 1200 D as amended and as relevant, shall apply to freehaul.

No additional payment will be made for excavating and backfilling bell (fox) holes as the cost of that work will be deemed to be included in the rates for trenching.

PSDB 8.3.2 Excavation

Delete Sub-Clause and substitute:

a) Excavation in all materials for trenches and dispose of surplus material. Rate to include for all temporary works including trimming, shoring and dewatering as required. b) Extra-over item (a) above for:

(1) Excavation in Intermediate material .....Unit : m^3

(2) Excavation in Hard rock material .....Unit : m^3

(3) Excavation in Boulder Class A material .....Unit : m^3

(4) Excavation in Boulder Class B material .....Unit : m^3

Separate items will not be provided for depth increments. Volume will be computed from the trench width determined in accordance with 8.2.3 and the depth from the top of the intermediate or hard rock excavation, as the case may be, either to the bottom of the same material or to the bottom of the trench as specified in (a) above, whichever is the lesser (see Drawing DB-5).

The rates shall cover the cost of the excavation and handling of the material as classified and the disposal of rock and other surplus or unsuitable material.

Measurement of Extra Over for (3) and (4) above will not apply to any length of trench in soft material more than 2 m long. Surplus boulder material from trench excavation shall where applicable, be disposed of to the designated spoil areas except where shown otherwise on the drawings.

PSDB 8.3.3.1 Make up deficiency in Backfill Materials

Payment for imported, graded stone laid under pipelines in accordance with PSDB 5.5 shall be paid for under either Sub-Clause 8.3.3.1(a) or (b) or (c) as scheduled.

PSDB 8.3.3.4 Overhaul

Delete the Sub-clause and substitute:

All haul will be regarded as free haul. There will be no overhaul payment in this contract.

PSDB 8.3.4(c) Cross Embankments (New Sub-Clause)

Payment for cross embankments will be by volume of embankment constructed in accordance with the specification. Unit : m^3

PSDB 8.3.5 Existing Services that Intersect or Adjoin a Pipe Trench

Add to the end of the Sub-Clause:

(v) all work involved in locating the service by hand excavation

(vi) notifying and attending upon the proprietor of the service

(vii) supporting and protecting the service while the pipeline is installed, inspected, tested and backfilled.

PSDB 8.3.6.2 Grassing (New Sub-Clause)

Grassing..... .... Unit : m^2

Approved grass shall be planted after topsoiling has been completed. The planted area shall be neatly trimmed, fertilised and watered. The Contractor shall ensure that the planted areas are not permitted to dry out. Any grass that fails to grow shall be replaced by the Contractor, at his own expense, with fresh grass, until satisfactory cover is obtained. The rate shall cover the supplying, planting and maintenance of grass, all in accordance with this specification.

PSDB 8.3.8 Sack Breakers (New Sub-Clause)

Sack breakers shall be installed from the bottom of the bedding to 300 mm below finished

ground level. .....
Unit : No

PSDB 8.3.9 Excavate Trial Holes to Determine Method of Excavation (New Clause)

Excavation by hand of trial holes of minimum dimensions 1,0 x 1,0 m to depth of 800 mm, or less if intermediate or hard rock material is encountered, along all pipeline routes at 50 m intervals. Including use of DCP for classification of material.

Including backfilling of the trial holes when notified by the Employer's Agent.

Hand excavation of trial hole.....
Unit No

C3.7.7 PSDM: EARTHWORKS

(Applicable to SABS 1200 DM - 1981)

PSDM 2.1 INTERPRETATIONS- Supporting Specifications

SABS 1200 A and SABS 1200 D are applicable to this contract.

PSDM 3 MATERIALS

PSDM 3.2.1 General

Add to the Sub-Clause:

The nomenclature used for the classification of various material types to be used in the designated pavement layers is that defined in the NITRR documents TRH4 and TRH14.

PSDM 3.3.1 Selection – General

Add to the Sub-Clause:

Should insufficient materials of a quality acceptable for use in the selected layer be found in the excavations the balance of the material required for the selected layer shall, when instructed by the Employer's Agent, be obtained from the Contractor's own source.

PSDM 3.4 Road Foundation Layers (New Sub-Clause)

The proposed gravel road foundation specification is:

- Rip and compact in situ roadbed material to 90% mod AASHTO density
- 150 mm imported G7 wearing surface compacted to 93% Mod AASHTO density

PSDM 5 CONSTRUCTION

PSDM 5.1.1 Safety, Existing Services, Stormwater, etc and Nuisance

Add to the Sub-clause:

All existing services may not be shown on the drawings or be visible to the Contractor on site. The Employer's Agent may order excavation by hand to expose such sources.

Where service is damaged because of the Contractor's negligence, he shall be liable for the repair of such service and shall bear all costs involved in the repair and other costs or losses due to the interruption of the services.

PSDM 5.1.2 Accommodation of Traffic (To be read in conjunction with SANS 1921-Part 2)

Add to the Sub-Clause:

The Contractor shall accommodate traffic on the existing roads. The Contractor is required to construct detour roads where sections of road are temporarily closed.

Work adjacent to existing roads must be properly barricaded – see PSD.

The Contractor shall provide signs for the temporary accommodation of traffic as required.

PSDM 5.2 Methods and Procedures

PSDM 5.2.2.5 Disposal of Surplus or Unsuitable Material

Add to the Sub-Clause:

Surplus and unsuitable material shall be disposed of as instructed by the Employer's Agent.

PSDM 5.2.8.1 Freehaul

Add to the Sub-Clause:

All movement of cut and fill material, borrow material and surplus material will be regarded as freehaul.

PSDM 5.2.8.2 Overhaul

Delete the Sub-Clause.

PSDM 8 MEASUREMENT AND PAYMENT

PSDM 8.2.1 Earthworks Measurement

Add to the Sub-Clause:

Earthworks will be measured by volume in compacted embankment once only as compacted fill from cut or borrow, whichever is applicable. Uncompacted fill from cut, material placed to stockpile or to spoil will be measured insitu as excavation.

PSDM 8.3.4 Cut to Fill, Borrow to Fill

Add the words: "and in borrow pits" after the words "road prism" in the second line of the payment paragraph.

Add the following:

"The rate shall also cover the cost of selection of suitable material in the borrow pit."

"The rate for borrow to fill does not include the cost of excavating, loading and unloading or anything which is covered by Item 8.3.4 of SABS 1200 D."

PSDM 8.3.5 Selected Layer compacted to 93% of Modified AASHTO Maximum Density

Replace this item with the following:

PSDM 8.3.5.1 Selected Layer from Borrow Pit (New Sub-Clause)

Selected layer compacted to 90% of modified AASHTO density Unit : m^3

The rates shall cover the cost of procuring, furnishing, transporting and placing the selected layer material and compacting the material to the specified densities."

PSDM 8.3.14 Borrow Pits

Replace the words: Sub-clause 8.3.6(b) of SABS 1200 D or Sub-clause 8.3.4 of SABS 1200 DA, as applicable" with Sub-clause 8.3.4(a) of SABS 1200 D."

Add the following items:

PSDM 8.3.14.1Material from Designated Borrow Pits (New Sub-Clause)

(a) Royalties payable on material from designated borrow pits ..... Unit : PC Sum

The amount allowed shall be expended in accordance with Clause 6.6 of the General Conditions of Contract and will be used to reimburse the Contractor for royalties paid to the landowner for material borrowed and used as subgrade and subbase.

(b) Percentage on amount paid to landowner for borrow material .....Unit : %

The percentage tendered shall include full compensation for any charges for labour, profit, transport, establishment and other charges the Contractor may wish to include.

PSDM 8.3.17 Accommodation of Traffic (New Sub-Clause) (to be read in conjunction with SANS 1921Part 2)

Accommodation of traffic ..... Unit : Sum

The tendered sum for the accommodation of traffic shall include full compensation for all items of cost necessary for such accommodation and the construction and maintenance of bypasses, including existing roads used as bypasses during the construction period. It shall also include full compensation for traffic control, the provision of traffic signs and, where necessary, communications equipment required to regulate traffic, for the construction of any necessary temporary drainage works, for the maintenance of all drainage works, arranging for the moving of services and subsequent reinstatement thereof, attending to traffic problems and complying with the requirements of the Road Traffic Ordinance and the relevant local authorities.

Payment shall be made in equal monthly instalments from the date of commencement of such work to the end of the contract period.

C3.7.8 PSGA : CONCRETE (SMALL WORKS)

(Applicable to SABS 1200 GA - 1982)

PSGA 2 INTERPRETATIONS

PSGA 2.3(a) General

Add to the Sub-Clause:

Adverse weather: Cold weather or weather in which:

(a) the ambient temperature is above 25^0C, or
(b) the relative humidity is low, or
(c) the wind velocity is high

or weather in which any combination of these three conditions occurs, and which tend to impair the quality of fresh or hardened concrete or otherwise causes the concrete to have abnormal properties.

PSGA 2.3(b) Quality

Add to the Sub-Clause:

Consistency: The extent, as measured by the slump test, to which fresh concrete resists flow or deformation.

PSGA 2.3(d) Exposure Conditions (New Sub-Clause)

Mild Conditions: Conditions under which the concrete is protected from the weather and exposed only to air.

Moderate Conditions: Conditions under which the concrete is:

(a) sheltered from severe rain and is not subject to freezing when wet, or

(b) buried in non-aggressive soil, or

(c) continuously under fresh water

Severe Conditions: Conditions under which the concrete is exposed or subjected to any of the following:

(a) driving rain

(b) alternate wetting and drying out

(c) freezing when wet

(d) fresh water (at the waterline)

(e) splashing or spraying with fresh water

(f) corrosive fumes or heavy condensation of water

(g) aggressive soil

(h) salt-laden air

PSGA 3 MATERIALS

PSGA 3.2.1 Applicable Specifications

The standard cement specifications SABS 471, SABS 626, SABS 831, SABS 1466 and SABS

1491, have been withdrawn and are replaced by SANS 50197-1: Common cements, and SANS 50413-1: Masonry cement. These specifications will be applicable to this Contract and the descriptions and types of cements, where specified, will be based on the designations as defined in these specifications.

Add to the Sub-Clause:

Unless agreed to otherwise by the Employer's Agent, the cement used on the works shall be either Type Cem 1, Type Cem 11/A-S or Cem 11/B-S (all of minimum strength Class 32,5).

PSGA 3.2.2 Storage of Cement

Add to the Sub-Clause:

Cement and other cementitious materials shall not be kept in storage for longer than two months without the Employer's Agent permission.

PSGA 3.4.4 Admixtures (New Sub-Clause)

Unless approved by the Employer's Agent, neither admixtures nor air-entraining agents shall be used in any concrete.

PSGA 3.4.5 Sand (New Sub-Clause)

Sand from a source selected by the Contractor and approved by the Employer's Agent after testing will be used under this Contract.

PSGA 4 PLANT

PSGA 4.4.2 Finish

Delete sentence and substitute:

The quality of the finished surface of the concrete shall be as scheduled.

PSGA 5 CONSTRUCTION

PSGA 5.1.2 Fixing

Add to the Sub-Clause:

Welding reinforcement as a means of securing it against displacement will not be permitted.

PSGA 5.1.3 Cover

Add "(with a tolerance of +10mm –0)", between "30mm", and "unless" in the second line of the Sub-Clause.

In second line read “40mm” for “30mm”

PSGA 5.2.1 Classification of Finishes

Delete the eighth and ninth lines of the Sub-Clause.

PSGA 5.2.1(a) Classification of Finishes - Rough

Add to the Sub-Clause:

The finish of the concrete is to be within the tolerances of Degree of Accuracy III as set out in SubClause 6.4.

PSGA 5.2.1(b) Classification of Finishes - Smooth

Add to the Sub-Clause:

The finish of the concrete is to be within the tolerances of Degree of Accuracy II as set out in SubClause 6.4.

PSGA 5.2.3 Removal of Formwork

Add to the Sub-Clause:

The minimum times for removal of formwork from concrete containing blast furnace cement given in Table 1 of SABS 1200 GA apply also to members of concrete made from a blend of equal parts of Ordinary Portland Cement and other cementitious materials.

PSGA 5.2.5 Fixing Blocks for Reinforcing and Fixtures in Concrete (New Sub-Clause)

Fixing blocks for the attachment of fixtures may be embedded in concrete provided that the strength and other desirable features such as appearance of the member are not, in the opinion of the Employer’s Agent impaired thereby.

The Contractor shall be responsible to provide samples of fixing blocks as proposed for use in the contract in good time for the Employer's Agent inspection. The acceptance of such blocks shall be subject to Employer's Agent approval.

PSGA 5.4.1.2 Consistency

Delete the third line and substitute the following:

Employer's Agent in respect of prescribed mix and/or strength concrete.

PSGA 5.4.1.4 Prescribed Mix Concrete

Delete the Sub-Clause and substitute the following:

The grades of prescribed mix concrete are designated Grades 20, 15 and 10 and are composed of cement, sand and stone, as specified hereinbefore, proportioned as follows:

Size of Stone	**Cement**	**Sand**	**Stone**
Grade			**$_3$)** **(m3)**
(mm)	**(kg)**	**(m**	
20/19	19	50	0,110 0,140
15/19 19	50 0,130	0,140 10/38	37,5 50 0,160
0,200			

While the proportion of cement to the combined quantity of sand and stone must remain constant for each grade of concrete, as set out above, the relative proportions of sand and stone are to be adjusted, if required by the Employer's Agent, so as to obtain the most suitable consistency of concrete, due to allowance being made for the bulking of sand due to moisture.

The addition of water shall be regulated by the use of properly calibrated containers, only sufficient water being added as will, in the opinion of the Employer's Agent, afford a workable mix.

The fine and coarse aggregates approved for use in strength concrete Grades 30 and 25 are to be used for prescribed concrete mixes Grades 20 and 15.

PSGA 5.4.1.5 Strength Concrete

Add to the sub-clause:

The grade of strength concrete is specified in the drawings

The concrete mix for the abovementioned grade of strength concrete is to be designed by an approved laboratory. At least four weeks before placing any concrete on the Works, the Contractor shall supply and deliver to the approved laboratory, at his own cost, samples of the aggregates he proposes to use in the concrete mix. While the proportion of cement to the combined quantity of sand and stone will remain constant for each grade of concrete, as set out above, the relative proportions of sand and stone may be adjusted to achieve the required strength. The laboratory will be bound by the requirements of this Specification which are to guide the Tenderers in pricing the grade of strength concrete. The Contractor is to allow in his rate for strength concrete an amount to cover the fees and charges levied by the approved laboratory in designing the strength concrete mix.

PSGA 5.4.1.6 Ready-mixed Concrete

Delete the Sub-Clause and substitute the following:

Concrete produced at a central concrete production facility other that at the site of the Works shall only be accepted for use in the Works with the prior and express approval of the Employer's Agent. The Contractor shall submit in good time, in support of his proposal, a concrete design mix, together with test results of the aggregates proposed and test results for the design mix when using the aggregates proposed, in the format as provided by the Employer's Agent. When such approval has been given concrete cubes and all other applicable tests shall be made on site and the test results obtained by the facility concerned will be used for reference purposes only.

PSGA 5.4.5.5 Adverse Weather Conditions (See PSGA 2.3(a)) (New Sub-Clause)

Under adverse cold weather conditions, effective measures shall be taken to ensure that the temperature of the concrete, from the time of placing until it has hardened (i.e. about 24 h), is maintained at not less than 5°C. If the atmospheric temperature in the vicinity of the concrete is below 2°C or is expected to fall below 2°C during the curing period (see Sub-Clause 5.4.7), water shall not be used for curing. All surfaces shall be protected from ice or frost damage.

When the ambient temperature is above 32°C, the temperature of the concrete when deposited shall not be allowed to exceed 32°C. Under adverse hot weather conditions, the Contractor shall take all reasonable steps to reduce to a minimum the placing temperature of the concrete. Stockpiles of aggregates and all metal surfaces in contact with aggregates and concrete shall be shielded from the direct rays of the sun or cooled by being sprayed with water, and

windbreaks shall be erected, if necessary, to prevent the initial rapid drying-out of concrete which would otherwise occur before normal curing procedures can be undertaken.

Concrete shall not be placed during periods of heavy or prolonged rainfall.

PSGA 5.4.7 Curing and Protection

Add to the Sub-Clause:

(d) continuously spraying the exposed surfaces with water.

(e) covering the concrete with waterproof or plastic sheeting firmly anchored at the edges.

The Contractor should base his method on water curing. The use of a curing compound shall not be allowed unless with the written approval by the Employer's Agent.

PSGA 5.4.8.2 Concrete Surfaces

Concrete surfaces shall be finished as indicated in the Schedule.

PSGA 6 TOLERANCES

PSGA 6.1.1 General

Read "Degree of Accuracy II" for "Degree of Accuracy III" in the third line.

PSGA 8 MEASUREMENT AND PAYMENT

PSGA 8.1.1.4 Formwork

Add to the first line between the words "concrete" and "and" the following:

"Including forming fillets or splays up to 20 x 20mm"

PSGA 8.4.1 Prescribed Mix Concrete

Delete from the Sub-Clause all but the first sentence.

Add to the Sub-Clause:

Where scheduled, the rate shall include for all shuttering and finishing.

C3.7.9 PSL: MEDIUM-PRESSURE PIPELINES (Applicable to SANS 1200 L)

PSL 2 INTERPRETATIONS

PSL 2.4 Abbreviations

Add to the Sub-Clause:

“CML”: Cement Mortar Lining

"FBMDPE: Fusion bonded medium density polyethylene."

PSL 3 MATERIALS

PSL 3.1 General

Add to the Sub-Clause:

"Steel pipes of diameter DN200 and above will be supplied by the Employer as “free issue.

Details of the pipes that will be made available by the Employer to the Contractor under this Contract

PSL 3.1.1 Materials Control (new sub-Clause)

Add new Sub-Clause:

PSL 3.1.1.1 Checking Material Lists and Drawings (new sub-Clause)

Add new Sub-Clause:

Not more than 4 weeks after the contract has been awarded the Contractor shall complete his check of the Materials Lists against the drawings and advise the Employer's Agent of any shortages or omitted items.

If any variations in the contract are authorised, the Contractor shall ensure that any additional items to be supplied by the Employer and the Contractor are ordered in good time so as not to cause delay to the works.

The Contractor shall check the delivery timing of all items and ensure that it is in line with the Contract programme. Any critical items that could be delivered late are to be brought to the attention of the Employer's Agent.

The delivery status of materials is to be checked and followed up upon by the Contractor throughout the contract.

PSL 3.1.1.2 Materials Control –General (new sub-Clause)

Add new Sub-Clause:

The Contractor is held responsible for the inspection and control on site of all the materials and equipment for the duration of the Contract. Once material and equipment has been accepted, any subsequent damage shall be made good to the satisfaction of the Employer's Agent at the expense of the Contractor. Damage to internal linings and external coatings that are necessary and incidental to good welding practices and the manufacturing of pipe specials are excluded.

Any item damaged beyond repair shall, at the discretion of the Employer's Agent, either be replaced at the Contractor's expense or the value reimbursed in full to the Employer.

PSL 3.1.1.3 Acceptance of Pipes, Fittings and Materials (new sub-Clause)

Add new Sub-Clause:

Before acceptance of any pipes, fittings or other items of equipment the Contractor is to carry out a thorough inspection to ensure that the materials have been delivered undamaged and are as ordered.

Pipes shall be checked for:

- Identification
- Certification
- Soundness and Internal lining
- Ends bevelled correctly
- Circumference according to specification and within tolerance

Inspection of pipe fittings, valves and other equipment shall include, but is not limited to:

- Identification
- Certification
- Material schedule and rating
- Lining, where specified
- Coating where specified
- Circumference according to specification and tolerance
- Damage to items – example flange faces

Defective items shall not be accepted, but marked, quarantined and immediately reported to the Employer's Agent.

If accepted, the Contractor shall take the required steps to ensure that all delivery documentation together with signed acceptance notes is filed in the Construction Dossier.

PSL 3.1.1.4 Material Storage (new sub-Clause)

Add new Sub-Clause:

The Contractor shall store all items so that no damage occurs whilst awaiting installation. Where practical, items are to be stored in lockable containers for protection from the weather and pilferage.

All piping, pipe fittings and equipment stored outside or awaiting installation are to be protected from the weather and storm water and soil wash and stored on pre-prepared surfaces. Pipes taken over from the Employer shall receive the required attention in order to ensure safe storage in yards, protected from fires, vandalism and incidental damage that can reasonably be prevented.

PSL 3.1.1.5 Handling Pipe, Fittings and Equipment (new sub-Clause)

Add new Sub-Clause:

Strict supervision shall be maintained at all times when handling pipes and equipment. Particular attention is to be given to correctly rated lifting gear, slings and lifting beams. All lifting gear is to be inspected regularly for signs of wear and tear in terms of the relevant Safety Legislation and Clauses. Equipment is to be lifted at the recommended points specified by the manufacturer. Pipe is to be lifted with a lifting beam and slings, which shall be fitted at quarter points around the pipe. Due care shall be taken when fitting and placing slings to ensure that ancillary items do not get crushed during lifting. Pipe coating is to be protected by padding or otherwise from scuffing damage during lifting.

The equipment utilized for lifting pipes is subject to approval by the Employer's Agent and all equipment judged unsuitable according to this specification or found to be unsuitable in practice shall be removed from site and replaced at the Contractor's expense. It is prohibited to handle pipes using chains or any other device involving metal contact with the pipe coating.

The Contractor shall ensure that all lifting equipment complies with the relevant safety regulations at all times.

Wet sponge tests shall be done to detect holidays on internal linings of the pipes.

The Contractor shall, at his own expense, test each and every surface area, that is internal as well as external coating during construction as per this specification. Testing for holidays shall be done after inclusion of materials, manufactured specials and equipment, as well as pipes, into the permanent works. Any defects found shall be repaired and the costs for remedial work shall be deemed to be included in the tendered rates for the construction of the pipeline. These tests and results shall be recorded on the Quality Control Plan as approved by the Employer's Agent.

PSL 3.4 STEEL PIPES, FITTINGS AND SPECIALS

PSL 3.4.1 General

Add to the Sub-Clause:

"Steel pipes of diameter DN200 and above that are to be used on this contract shall be supplied by the Employer as free issue" and shall be collected by the Contractor at the pipe yards indicated by the Employer's Agent and transported to Site including stringing them along the pipeline route, the contractor shall factor in all costs of transportation and handling in his rate. All fittings and specials supplied by the Contractor under this Contract shall be to the dimensions and details shown on the drawings or as scheduled in the Bills of Quantities. Each piece shall have its relevant item number stamped and painted onto the exterior surface prior to despatch from the manufacturer's premises.

Steel pipes DN 150 and smaller shall be manufactured in accordance with SABS 62.

SANS 719

Steel pipes supplied by the Employer shall be checked for acceptance by the Contractor in accordance with SANS 719 and including the integrity of the coatings and linings.

8.2 SANS1200L ADD:

SECTION: COLLECTION, HANDLING, LAYING, TESTING, DISINFECTION AND CCTV INSPECTION OF FREE-ISSUE PIPES

(Applicable to all free-issue pipes as specified in the Contract Documents)

1. SCOPE

This section covers the requirements for the collection, transportation, handling, laying, bedding, jointing, testing, disinfection, and internal condition assessment of free-issue pipes supplied by the Employer and made available at designated pipe yards, as specified in the Contract Documents or as directed by the Engineer the **Contractor shall refer to item 2.4-1,2.4-2 and 2.4-3 and reference this** specification when pricing, and should develop an all inclusive rate to cover collection handling transportation, laying testing including testing of welds with equipment as specified in API standards attached herein with the procedures to be followed. The pipe line building rate shall be all inclusive of the below and API Specifications

2. MATERIALS

2.1 All pipes shall be supplied as free-issue materials by the Employer. The Contractor shall verify the quantities, diameters, and physical condition of the pipes at the pipe yard before collection.

2.2 Any materials required for loading, transportation, bedding, jointing, testing, disinfection, or inspection shall be supplied by the Contractor and shall comply with the **relevant SANS 1200, API, or manufacturer's specifications for the pipe type, coating, and lining system.**

3. CONSTRUCTION

3.1 Collection and Transportation

- The Contractor shall collect the free-issue pipes from the designated pipe yard(s) as identified in the Contract Data or as instructed by the Engineer.
- The Contractor shall provide all equipment, vehicles, lifting gear, slings, and personnel necessary for safe loading, securing, transportation, and off-loading of the pipes.
- Pipes shall be transported in a manner that prevents any damage to coatings, linings, or pipe ends. Dragging or dropping of pipes shall not be permitted.
- The rate shall allow for all distances between the designated pipe yard(s) and the project site area(s) where the pipes are to be incorporated, including any temporary storage or staging areas along the route.

3.2 Handling and Stringing

- Pipes shall be off-loaded and strung along the pipeline alignment in accordance with the Drawings or as instructed by the Engineer.
- Care shall be taken to avoid coating damage. Where damage occurs, repairs shall be undertaken immediately using approved 3LPE repair materials in accordance with the manufacturer's instructions.

3.3 Laying and Bedding

- Laying of pipes shall conform to SANS 1200 LB and SANS 1200 LD.
- The Contractor shall provide approved bedding material, compacted to the specified density, and ensure correct alignment, gradient, and jointing of all pipes.
- Jointing shall be carried out strictly in accordance with the pipe manufacturer's recommendations, and witnessed by the Engineer when required.

3.4 Testing, Disinfection and CCTV Inspection

- Upon completion of laying, the Contractor shall conduct pressure tests, leakage tests, and disinfection of the installed pipelines in accordance with SANS 1200 L and SANS 241.
- The Contractor shall provide suitable CCTV equipment and qualified personnel to carry out internal visual inspection and condition assessment of the cement-mortar lining for all pipe sizes, including 200 mm ND, 300 mm ND, and 350 mm ND.

- CCTV inspection shall confirm the condition, continuity, and integrity of the internal lining prior to commissioning, and a digital report with footage shall be submitted to the Engineer for review.
- The cost of CCTV inspection, including all equipment, recording, reporting, and access arrangements, shall be fully included in the Contractor's rate for this item.
- The rates shall include all labour, equipment, temporary works, water for testing, disposal arrangements, and reinstatement after testing or inspection.

4. MEASUREMENT AND PAYMENT

Unit of Measurement:
Linear metre of pipe, measured along the pipe centreline in the trench, or as otherwise stated in the Bill of Quantities.

Payment Item:
Collection, handling, transportation, laying, bedding, jointing, testing, disinfection, and CCTV inspection of Employer's free-issue pipes.

The rate shall be all-inclusive and shall cover, but not be limited to, the following:

- Collection and loading of pipes from the designated pipe yard(s);
- Transportation to site, including all fuel, labour, and equipment costs;
- Off-loading and stringing along the proposed pipeline route;
- Laying, bedding, and jointing of pipes;
- Pressure testing, leakage testing, and disinfection;
- CCTV inspection and reporting on internal lining condition of 200 mm ND, 300 mm ND, and 350 mm ND pipes;
- Repair of coating or lining damage where required; and
- Compliance with all safety, environmental, and quality assurance requirements.

No additional payment will be made for transport distances between the pipe yard(s) and the site, or for any repair to pipes damaged through improper handling.

PSL 3.4.4 Fittings and Specials

Add to the Sub-Clause:

"All bends, fittings and specials shall be manufactured from straight pipe specified elsewhere unless otherwise stated in the Bills of Quantities.

All steel bends, fittings and specials shall be fabricated to the dimensions and details shown on the drawings and/or described in the Bills of Quantities.

The sides of taper pieces shall diverge at an angle of not more than 11° to each other.

The bend, fitting, and special fabricator shall supply written confirmation that all hand welding was carried out by coded welders.

Individual bends, fittings and specials smaller than DN 300 shall be hot dip galvanised to heavy duty grade in accordance with SABS 121:2000 after fabrication. Where a hot dipped galvanised fitting is to be welded to a coated and lined pipe, the galvanising is to be abraded off prior to welding. The external coating at the welded joint is to be primed and coated with an approved anti corrosion system.

Bends, fittings, and specials of DN 200 and larger shall have the internal lining and external coating made continuous ("made good") as specified elsewhere for welded joints on coated and lined pipes.

Bends, fittings and specials shall be manufactured and tested in accordance with the specification for straight pipe and additionally with Section 8 of BS EN 10311: 2005 and BS 10224: 2002. The nominal dimensions of each bend, fitting and special required are itemised in the Bills of Quantities and/or on the drawings and 'exact length' tolerances shall be adhered to. All plain ends on bends, fittings and specials shall have the plain ends prepared for butt welding except those plain ends that are to be jointed with adaptor joints.

Bends shall generally be of the segmented type except where otherwise stated or shown on the drawings.

The bend, fitting, and special fabricator shall supply written confirmation that all hand welding was carried out by coded welders.

The Contractor will be responsible for the provision of strengthening webs, crotch plates, gussets etc as may be necessary to prevent excessive deflection or deformation of fittings and specials when subjected to hydraulic pressure tests, and the tendered rates for the work will be deemed to include for the design and provision of this reinforcing wherever necessary. All crotch plates, wrappers, collars and gussets to be provided by the Contractor under this Contract are to be manufactured from API 5L Grade X42 steel.

Bends shall be fabricated in accordance with the Table below.

DN200,300 &350 Deflection of Angle	
Up to and including 3°	One pipe end scarfed on site
Exceeding 3° and up to and including 9°	Mitre cut (two pipe ends scarfed on site)
Exceeding 9º but less than 15º	2 segment bend
15º and larger but less than 30º	3 segment bend
30º and larger but less than 90 º	4 segment bend

Bends greater than 90º shall be fabricated from combinations of items from the table above.

Shop drawings of bends, fittings and specials shall be submitted to the Employer's Agent for approval prior to manufacture.

All flanged bends, fittings and specials shall be hydraulically tested at the fabricator's premises to the same pressure that they will be subjected to during the hydraulic testing of the completed pipeline. No visible signs of leakage will be permitted."

PSL 3.4.5 Puddle Collars and Anchoring Flanges (New Sub-Clause)

Add new Sub-Clause:

"Puddle collars and anchoring flanges used as pipe anchorages shall be of the same dimensions as corresponding flanges but those cast into concrete walls are to be undrilled. The collar/flange shall be capable of transmitting a longitudinal force 33% greater than the internal hydraulic pressure to be applied when testing, multiplied by the area of the bore and, under that condition, the stress in the material shall not exceed its yield stress.

Where puddle collars are shown on the drawings as being 20 mm thick, those collars are not required to transmit thrust, their purpose being to assist with the waterproofing of the concrete chambers by increasing the path that ground water might have to take to enter the chambers.

Where polyethylene pipes are cast into concrete structures, they shall be specially prepared and adapted by positioning a custom-made tight-fitting natural rubber sealing sleeve around the circumference of the pipe and in the case of structured-wall pipe creating shear keys through removing small segments of the outer wall. The rubber seal shall be 10 mm thick and 200 mm wide or 80% of the width of the wall and shall be 60 to 65 shore hardness, with a vulcanised joint. It shall need to be stretched over the pipe circumference to ensure a tight fit."

PSL 3.4.6 Closure Pipes (New Sub-Clause)

Add new Sub-Clause:

"Closure pipes, which are to be cut on site to the exact lengths, shall have the diametrical tolerances specified for the pipe ends applied over the full length of the pipe. Closure pipes shall be supplied in standard lengths."

PSL 3.4.7 Welding Tests at fitting Fabrication Shop(s) (New Sub-Clause)

Add new Sub-Clauses:

"PSL 3.4.7.1 Qualification Tests for Welding Procedures

Only appropriately coded welders may be used.

The qualification tests for welding procedures shall be carried out generally in accordance with the requirements of the American Petroleum Institute API 1104. The detailed procedure to be adopted during manufacture shall be established and the quality of the welds so produced shall be determined by carrying out one transverse tensile weld test and two guided cold bend tests on suitable coupon plates.

The tests are to be carried out either before fabrication of fittings is commenced.

The coupon plates shall be prepared either from plates of the same material as the pipe and welded in a similar manner to that to be used during production, or by cutting suitable specimens from a pipe selected at random by the Employer's Agent from the first production. The coupon plate for the tensile weld test and those for the guided cold bend tests shall be prepared in accordance with the requirements of SANS 719.

The qualification tests shall be considered satisfactory if:

a) The weld has a joint efficiency greater than 95% of the minimum specified tensile strength of the parent metal and,

b) The bend test specimens are capable of being bent around a former with a diameter equal to six times the nominal thickness of the plate to an angle of 180 degrees without developing a crack, except at the arrises of the specimen, of length or width greater than 3 m.

Failure to pass the above qualification tests shall result in the rejection of any pipes welded with the procedure used and the preparation of a new qualification of procedure test.

Any changes in the electrode case type used or change of flux used shall require a qualification test before approval of the procedure is granted.

PSL 3.7 OTHER TYPES OF PIPES

PSL 3.7.2 Polyethylene Pipes

Add to the Sub-Clause:

"HDPE and LDPE pipes shall be of the classes scheduled. Jointing of pipes shall be by means of bolting up welded-on flanges or by the use of approved external compression type fittings ('Plasson' or similar approved)."

PSL 3.8 JOINTING MATERIALS

PSL 3.8.2.1 Flexible Couplings

Delete the Sub-Clause and substitute the following:

"Where ordered, steel flexible couplings are to be of the "Viking Johnson"/"Klamflex"/ "Aqualok" or similar approved type without central registers, each comprising one centre collar, two special flanges, two rubber rings and hot dipped galvanised mild steel bolts.

Steel couplings shall be assembled strictly in accordance with the manufacturer's instructions and all bolts shall be torqued to the value recommended by the manufacturer. On completion of hydraulic pressure testing of the installation, the entire joint shall be protected as described in Clause PSL 3.9.3.6.

The tendered prices for laying and jointing are to include for the supply of all necessary materials, plant and labour to complete the joint.

Flexible couplings shall conform generally to BS 10311: 2005 for slip-on type couplings and shall be of approved manufacture. They shall be capable of being tightened and released without damaging or improperly distorting the rubber seating rings and shall be designed to prevent the rubber rings being blown out under pressure or sucked in under vacuum.

Each coupling is to be capable of withstanding the test pressure applicable to the pipes with which they are to be used without exceeding a stress in the steel of 67% of the yield point.

Mild steel couplings shall be protected by an approved epoxy coating system such as an approved solvent-free epoxy (SFE) system such as "Nordbak 1" or similar approved system and applied within 4 hours of abrasive blast cleaning the metal surfaces of the coupling in accordance with ISO 8501-1 Grade Sa 2,5. Nuts, bolts and washers shall be hot dipped galvanised. The plain end of the pipe shall be properly prepared, and in the case of steel pipes before corrosion protection, so as to accept the flexible coupling.

Adaptor couplings and anchoring adaptor joints shall comply with the above specification for flexible couplings and be of a similar design, but one end shall be flanged to enable connection of plain ended pipes to flanged joints. The adaptor joints are to be complete with bolts and nuts for connecting the flanged joint to the anchoring flange situated generally 300 mm to 400 mm from the plain end of pipe. All bolts, nuts and washers are to be hot dipped galvanised. In order to anchor the plain ended pipe to the flanged joint all of the bolts for the flanged joint are to pass though the anchoring flange

and are to be fitted with nuts and washers at the flanged joint and on either side of the anchoring flange."

PSL 3.8.3 Flanges and Accessories

PSL 3.8.3.1 Bolted Connections (New Sub-Clause)

Add new Sub–Clause:

"All flanges, gaskets, bolts, nuts washers and other appurtenances required for the execution of the work under this Contract shall be supplied and installed by the Contractor under this Contract and shall comply with the following:

- The sizes and drillings shall generally comply with SANS 1123 as shown on the drawings or as scheduled in the Bills of Quantities.
- Flanges cut from steel plate shall be machined flat on the front face, but with a raised face.
- No machining need be carried out on the back face (except where insulating flanges are to be installed) provided that face is sufficiently flat to ensure square bedding of the bolt heads and nuts and provided that all weld reinforcement is removed.
- Temporary end covers shall be provided by the Contractor for protection of flanges, and prepared plain ends of pipes and fittings to prevent damage to internal lining during transportation and during handling on site.
- All piping and flanged surfaces shall be cleaned before connections are made.
- The (raised) faces of flanges that are in to be in contact with gaskets shall be masked and shall not be painted or coated. The mating flange shall then receive one coat of an approved rust inhibitor. Care shall be exercised to ensure that after the application of all coatings there are no runs or drips on the mating surfaces of the flanges and that the flange profiling is clearly visible over the entire face. Excessive coating build up in flange bolt holes that could snag bolts will not be permitted.
- Flanged joints shall be connected with the specified bolts, nuts and washers all of which are to be supplied by the Contractor.
- All bolts, tie-bolts, nuts and washers shall be galvanised to SANS 121: 2011 and shall comply with the relevant requirements of SANS 135: 2011 and SANS 136: 2008 where applicable.
- The length of each bolt shall be such that after the bolt has been tightened, the end of the bolt shall project beyond the outer face

of the nut, but not by more than two threads. Tiebolts on restrained/anchoring couplings shall be fitted with “backing nuts” and washers.

- Each flanged joint is to be fitted with an approved and suitably rated gasket and sealed watertight such that there will be no visible sign of leakage under the specified factory and field test pressures and under the in-service working conditions (pressures).

- All bolts are to be tightened in a predetermined pattern with opposing bolts being tightened sequentially. When all bolts are tight, each bolt is to be torqued to the required/recommended torque in a predetermined pattern with opposing bolts being tightened sequentially.

- All bolt threads shall be liberally coated with “Copper slip” or similar approved compound prior to assembly. Upon completion, bolt heads, washers and nuts shall be wrapped with the “Denso Mastic Blanket System” comprising of a priming solution, mastic blanket, petrolatum tape and lay-flat sheeting as described in elsewhere."

PSL 3.8.4 Loose Flanges for Welding

Add to the Sub-Clause :

"Flange jointing material, when installed in the complete pipeline, shall be capable of withstanding transient pressures of up to the specified field test pressure. Under this condition no damage shall be caused or leakage occur through the joint. Bolts and nuts shall be galvanised to SANS 121: 2011 and shall comply with the relevant requirements of SANS 135: 2011 and SANS 136: 2008 where applicable."

PSL 3.9 CORROSION PROTECTION

PSL 3.9.2 Steel Pipes

PSL 3.9.2.1 Holiday Testing (New Sub-Clause)

Add new Sub-Clause:

"All Holiday Testing shall be carried out with an instrument approved by the Employer’s Agent.

The sparking detection test shall conform to the standards as set out in SANS 1217:2001. The Contractor shall familiarise himself with the

dielectric strength (breakdown strength) of all the coatings and linings he works with for the different pipe sizes. The Contractor shall also have an in depth knowledge of the Holiday Testing equipment he works with, in order to calculate the Corona discharge effect for the typical brush being utilised, with reference to the specific ambient conditions for any specific test.

All Holiday Testing shall be executed at a voltage which is set at 50% of the value of the dielectric strength of the lining or coating being tested. The Contractor shall carefully analyse the loss in test voltage as a result of the Corona Effect, specific to the ambient conditions surrounding the test. The test voltage of the Holiday Testing equipment shall be adjusted such that the voltage drop as a result of the Corona Effect will be taken into account when the actual 50% threshold of the dielectric strength is calculated.

The Holiday Test equipment shall be calibrated by an approved supplier and checked every 30 minutes or every time a test at a different location is started. Each piece of equipment shall have a unique identification number with calibration certificates and detail of equipment utilized shall be submitted to the Employer's Agent for approval. Method statements for the process of holiday testing shall be submitted to the Employer's Agent for approval.

The correct equipment for the type of application will be utilized. For example, where pin holes have been repaired and retesting for effectiveness of repair work being done, the Contractor shall utilize the correct equipment to effect same and this shall include the use of a pencil brush which concentrates the efforts of holiday testing at the repair. Where spark tests are performed on Tape Wrap systems, the minimum brush width shall be 300 mm. The brushes utilized shall be brass bristle cone brushes. The typical brush speed shall be 200 to 300 mm/sec when doing spark tests.

The Contractor shall, at his expense, test each and every surface area, that is internal lining as well as external coating, during construction as per this specification. Testing for holidays shall be done after inclusion of materials, manufactured specials and equipment, as well as pipes, into the permanent works. Any defects found shall be repaired and the costs for remedial work shall be deemed to be included in the tendered rates for the construction of the pipeline. These tests and results shall be recorded on the quality control plan as approved by the Employer's Agent."

PSL 3.9.2.1.1 Holiday Testing of Pipe at Pipe Yards (New Sub-Clause)

Add new sub-clause:

It shall be the Contractor's responsibility to detect defects in free issue pipes, including their ends, coatings and linings before taking receipt. The Contractor shall execute holiday detection tests on all the pipe coatings in the pipe yard before uplifting and transportation commences, and this will be subject to witnessing and sign off by the Employer's Agent or an appointed third party inspection authority. This will determine the baseline to be used when handling and transportation damage, if any, is assessed.

PSL 3.9.2.1.2 Holiday Testing of Pipe at Work Fronts (New Sub-Clause)

Add new sub-clause:

The coating of each pipe shall be inspected, and holiday detected by the Contractor immediately prior to being laid and these inspections shall be subject to witnessing and sign off by the Employer's Agent or an appointed third-party inspection authority. Two thirds of the circumference will be inspected outside the trench, after the pipe has been transported to the construction site where the pipe will be laid, and the balance of the circumference will be inspected once the pipe has been laid into the trench and rotated 180°. All testing shall be marked on the pipe from start of test point to completion of test point. All remedial work shall be effected immediately upon detection of any holidays. The cost of holiday testing and effecting remedial work to the coating of the pipe at the installation location as a result of construction or transportation damage by the Contractor shall be deemed to be included in the tendered rates for the laying of the pipe.

PSL 3.9.2.1.3 Holiday Testing on Tape Wrap Systems (New Sub-Clause)

Add new sub-clause:

Each and every external coating repair at welded joints, that are repaired with a tape wrap system, shall be holiday tested and subject to approval in terms of the relevant Quality Control Plan. All costs for the holiday detection shall be deemed to be included in the tendered rates for the laying of the pipe.

PSL 3.9.3.1 Preparation of Steel Surfaces for Repairs and/or Reinstatement of Internal Lining and/or External Coating (New Sub-Clause)

Add new Sub-Clause:

"The following method is applicable to the preparation of exposed steel surfaces prior to the carrying out of any repair procedure to internal linings and/or to external coatings. This specification is applicable to all steel surfaces that have been stripped of its corrosion protection layer, internally or externally, as a result of the manufacturing of specials, construction activities or pipe laying, welding and/or damages caused by handling or latent defects in application.

(a) Degreasing:

All bare metal surfaces shall be degreased in order to remove grease and oil from the pipe surface as a first step in the preparation process i.e. before grit blasting and/or power brushing starts. Degreasing shall be carried out using an approved water based solvent degreaser such as that complying with SANS 1216 or, for use in enclosed systems, with SANS 1365. The surface shall then be cleaned with potable water and left to dry completely before the next step is taken.

(b) Grit Blasting – Internal Lining Repair:

Grit blasting of bare metal surfaces shall take place after degreasing of the area. Abrasive material used for blast cleaning shall be free from oil or grease, as shall be the compressed air used in air blast cleaning.

The finished grit blasted surface shall be to Sa 2,5 of ISO 8501-1 with a 75 micron angular profile. Hackles shall be removed with coarse abrasive paper.

Transition areas from internal lining to bare metal which has been grit blasted, shall be smooth without rough edges or flaking appearances.

All grit blasting within the pipeline that is under construction, shall be performed by way of a "vacuum blast" process in order to limit the generation of dust. Grit blasting shall, under all circumstances, be carried out using equipment suitable for the size of the work to be undertaken.

Damp hessian sacking or other suitable material is to be temporarily fixed around the pipe on both sides of the work areas to prevent damage to the adjoining pipe coating/lining.

All residual dust and debris shall be removed.

The Contractor shall provide the Employer's Agent with a method statement for approval for each type/location of grit blasting, before work commences.

(c) Power Brush – External Coating Repair:

Power brushing of bare metal surface shall take place after degreasing of the area as specified. The area that has been power brushed shall be free from rust, laitance, dust, oil or other deleterious matter before the application of primer. Any areas in the region where power brushing took place shall be free from signs of disbonding of lining and/or coating, once power brushed. The surface finish, once power brushing has been completed, shall conform to minimum St 2 standard."

PSL 3.9.3.2 Preparation Mixing and Application of Epoxy Compounds (New Sub-Clause)

Add new Sub-Clause:

"When mixing two part epoxies the base and activator shall be mixed in accordance with the manufacturer's instructions. Mixing in the original container will only be permitted by means of methods that ensure full integration of different parts of the compound into a homogeneous compound with the characteristics as intended by the manufacturer. The different parts of the compound shall not be diluted. Mixing shall only be allowed with full batches and reduction of volumes from mixing packs by means of weight or volume measurement, which will result in smaller portions to be mixed, will not be allowed. In the application of the epoxy the following shall be strictly in compliance with the manufacturer's instructions:

- Method of application (Type of brush or roller.)
- Over coating time.
- Temperature range for application.
- Method of mixing base and activator.
- Number of coats to achieve the specified thickness.
- Safety aspects e.g. Eye and hand protection, ventilation, fire precautions, etc.
- Note that roller and brush applicators shall be replaced once the product application expiry time has been reached on any specific applicator tool.

Uncured epoxy must be regarded as being toxic and shall be handled in accordance with the manufacturer's instructions. Adequate lighting and ventilation shall be provided whilst working within the pipeline.

Only solvent free epoxy repair kits shall be utilized to repair the internal linings of the pipeline. This specification refers to "two-part epoxy" as an epoxy repair kit which consists of a base and an activator approved by the Employer's Agent and could be products similar to "Denso ST100", "Sigma SF 523", "Nordbak", etc.

Attention is drawn to the fact that "Nordbak 1" or similar approved, is to be used on this Contract. For the repair of cement mortar linings, "Epidermix 338" or similar approved shall be used.

The Contractor's tendered rates for the laying of the pipe shall be deemed to include for all the repairs and make-goods that have to be effected in order to deliver a serviceable and acceptable pipeline. (This excludes such repairs as instructed by the Employer's Agent as a result of manufacturing defects, if any).

Two-part epoxy may only be applied on steel surfaces prepared as specified in PSL3.9.3.1."

PSL 3.9.3.3 Making Good of Cement Mortar Lining at Welded Joints (New Sub-Clause)

Add new Sub-clause:

All cement mortar lined pipes shall have their cement mortar lining stopping between 50 mm and

75 mm from each plain end and from each end and it shall be 'chamfered' by 15 degrees to provide a positive dove-tail joint for the epoxy repair plug after field welding to another pipe.

When cement mortar lined straight steel pipes are cut, the cement mortar lining is to be cut back between 50 mm and 75 mm from the cut end of the pipe and "chamfered" by approximately 15 degrees to provide a positive dove-tail joint for the epoxy mortar repair plug after butt welding.

The surfaces are to be prepared as specified in PSL3.9.3.1.

A 50 mm wide by 20 mm thick band of "Epidermix 338" or similar approved epoxy, shall be applied internally on the uncoated steel adjacent to the cement mortar lining. The plain end of the adjoining pipe shall be pushed into the bellmouth (or into the external sleeve when there is no bellmouth) in such a way that the epoxy band is compressed and makes contact with the transverse face of the cement mortar lining of both pipes. The excess material that is squeezed into the bore of the pipes is to be removed by drawing a suitable plug that is 5 mm smaller than the bore of the cement mortar lining across the joint. The plug that is used shall be such as to render an even and smooth finish to the epoxy at the joint. The timing of when the plug is pulled through is critical and shall be carefully controlled."

PSL 3.9.3.4 Repair and Making Good of Solvent Free Epoxy Linings (New Sub-Clause)

Add new Sub-clause:

"All making good of internal solvent free epoxy linings at damaged areas and at welded and flanged joints that is required to ensure continuous internal corrosion protection to steel surfaces shall be carried out strictly in accordance with the solvent free epoxy manufacturer's specifications. The surfaces are to be prepared as specified in PSL3.9.3.1.

The epoxy material shall be sufficiently thixotropic that 500 micrometres dry film thickness can be achieved in one application without sagging. The material shall be applied to the clean, dry, abraded area so as to fully cover it and extend to no less than 50 mm of the edge of the abraded area. A "halo" of abraded area shall be visible around the repair material.

After curing, the repaired section and at least 250 mm of the surrounding area, shall be tested for electrical insulation defects as specified elsewhere. There shall be no electrical insulation defects.

The Contractor shall ensure that repairs and particularly the making good of linings at welded joints, is carried out progressively as the pipe is being laid and shall not be permitted to lag behind for more than three pipe lengths at each working front."

PSL 3.9.3.5 External Corrosion Protection of Factory Welded Joints and Coating Repairs (New Sub-

Add new Sub-clause:

"All factory coated steel pipes will supplied with the external coating cut back 100 mm from each pipe end. Where pipes are to be cut, either on site, or for the purpose of fabricating bends, fittings and specials, or in the event of the pipe coating being damaged, the pipe coating shall be cut back 100 mm from the intended cut area before the pipe is cut. Damp hessian sacking or other suitable material is to be temporarily fixed around the pipe to prevent damage to the pipe coating during welding operations. Once welding is complete, and all weld splatter and burnt coating has been removed, the welded pipe joints shall be wrapped in the following manner.

The following specification is based on "Denso" products and systems. Alternative products and procedures may be proposed by the Contractor and, if approved by the Employer's Agent, they may be used. Irrespective of which products are approved by the Employer's Agent and used by the Contractor, all procedures shall be carried out strictly in accordance with the Contractor's method statements which must conform to the manufacturer's recommendations.

A fundamental outcome is a sound and continuous coating that is free from wrinkles and that does not have any entrapped air pockets or any air bubbles.

a) <u>Surface Preparation:</u>

The bare metal shall be cleaned, and wire brushed to minimum St 2 standard and degreased with white spirit. The adjacent pipe coating shall be cleaned to a minimum of 300 mm either side of the joint and the edges "feathered" to achieve a tapered transition over a distance of 100 mm. The sound, parent coating surface shall be roughened with sandpaper over an area 250 mm either side of the joint.

b) <u>Priming:</u>

The entire pipe and coating surface over a length of 250 mm on either side of the joint shall be primed using "Denso Primer D" (or equivalent approved). Care shall be taken to obtain a thin even film with no runs or sags. The primer shall be allowed to cure until "tack dry" before the application of the tape commences. Priming may only be carried out on those areas that are to be wrapped that same day. If primed areas are to be left overnight, those areas shall be re-primed before wrapping.

c) Profiling Tape: A 1,5 mm thick x 50 mm wide “Denso Mastic Sealing Tape” (or equivalent approved) shall be applied to the full circumference of the weld bead in accordance with the manufacturer’s specifications. Care shall be taken to ensure a smooth profile and to avoid air bubbles being trapped beneath the tape. (Note: The profiling tape may be omitted at the discretion of the Employer’s Agent. Tenderers shall nonetheless allow for the profiling tape in their tendered rates).

d) Tape Wrapping:

The joint shall then be wrapped (minimum 55 % overlap) with “Denso CPT 1250/300 Polyethylene/Bitumen” tape starting at the roughened section (250 mm from the welded joint) in accordance with the manufacturer’s requirements to create a 500 mm wide wrapping, centred over the welded joint. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. It is important that tension in the tape be released when the wrapping of the last half circumference of the pipe. The Contractor shall ensure that the wrapping overlaps or covers a minimum of 150 mm of the pipe coating. A secondary or outer tape wrap layer is then to be applied over the first layer with a 10% tape overlap.

An alternative tape wrapping system that may be used is the “Densotherm 35 Hot Applied Bitumen Tape” system. The procedures are similar to those for the “Denso” system described above except that the underside of the tape shall be heated as it is applied, and the overlaps and seams of the tape are to be sealed by means of a heated tool."

PSL 3.9.3.6 External Corrosion Protection of Shop-Fabricated Pipe Bends and Fittings (New Sub Clause)

Add new Sub-Clause:

The external coating of shop fabricated bends and fittings shall be carried out as follows:

- Where a substantial part of the external coating on the parent pipe is intact, the coating repairs/make good shall be carried out in accordance with PSL 3.9.3.5 or
- Where black (uncoated pipe has been used), the coating shall be carried out with an approved solvent-free epoxy (SFE) system such as "Nordbak 1" or similar approved system or
- Where only a relatively small proportion of the external coating on the parent pipe remains, all of the remaining coating shall be removed, and the entire bend/fitting shall be coated with an

approved solvent-free epoxy (SFE) system such as "Nordbak 1" or similar approved system.

All crotch plates and wrappers/collars shall be coated an approved solvent-free epoxy (SFE) system such as "Nordbak 1" or similar approved system.

After application of the SFE coatings to the crotch plates and collars/wrappers, approved mastic (refer PSL3.9.3.8) shall be placed in all crevices that may become moisture traps.

No additional payment will be made for any of this work as the costs are deemed to be included in the scheduled rates for pipelaying.

PSL 3.9.3.7 External Corrosion Protection of Site-Fabricated Pipe Bends and Fittings (New Sub-Clause)

Add new Sub-Clause:

"The coating repairs/make good shall be carried out in accordance with PSL 3.9.3.5."

PSL 3.9.3.8 Corrosion Protection of Flanges and Flexible Adaptor/Anchoring Joints (New Sub-Clause)

Add new Sub-clause:

"All flanges and flexible joints and adaptor/anchoring joints and their associated bolts, nuts and washers, shall, notwithstanding that the flexible and adaptor/anchoring joints will be epoxy coated as specified elsewhere, be protected as described below.

(Note: This specification is based on a “Denso” system. Alternative products may be used, subject to approval by the Employer’s Agent).

a) Surface Preparation:

The entire surface area of the flange/adaptor/anchoring joint, and its bolts, nuts and washers, up to no less than 250 mm either side of the joint, shall be cleaned of all dirt and other deleterious matter. The cleaned area, up to 200 mm either side of the flange/adaptor/anchoring joint, shall then be wire brushed.

b) Priming:

The cleaned flange/adaptor/anchoring joint, bolts, nuts, washers and the adjoining 200 mm length either side shall be primed with “Denso Priming Solution”, or if moisture is present, with “Denso S105 Paste”.

c) Application of Mastic Blankets:

Narrow strips cut from “Denso Mastic Blanket” shall be applied to the flange/ adaptor/anchoring joint to achieve a smooth profile with a 50 mm splayed fillet being

formed at the joint/pipe interface. Care shall be taken, particularly at bolts, to avoid the formation of air pockets. Complete "Denso Mastic Blankets" shall then be applied (mastic side down) to the flange/adaptor/anchoring joint until the flange/adaptor/anchoring joint is completely enveloped.

The blanket shall be overlapped at least 50 mm and shall extend at least 150 mm along the pipe barrel on each side of the flange/adaptor/anchoring joint. The ends of the blanket shall be bound to the barrel of the pipe on each end with 100 mm wide "Denso Tape". The "Denso Tape" overlaps shall be 50 mm and shall extend 100 mm onto the blanket and 150 mm onto the pipe barrel.

d) Application of Protective Sheeting:

The entire flange/adaptor/anchoring joint shall then be wrapped with 350 micron polyethylene sheeting which shall end 400 mm beyond the joint. The protective sheeting shall be secured to the pipe barrel and along the seam with 48 mm wide "Denso Adhesive Tape"".

PSL 3.9.3.9 Coating of Permanently Exposed Pipes/Fittings (New Sub-Clause)

Add new Sub-Clause:

"All pipes which are to be permanently exposed shall, in addition to the specified corrosion protection at flange/adaptor/anchoring joints, be protected with the "Denso Acrylic Pipeline Tape (Steelcoat 500)" system or similar approved UV resistant coating. The pipe surface shall be prepared and the coating applied in strict accordance with the manufacturer's instructions. a) Surface Preparation:

The pipe surface to be wrapped shall be cleaned of dirt, grime, grease and other deleterious matter, using white spirit if necessary and then allowed to dry thoroughly. b) Priming: "Denso Primer D" shall be applied to the prepared surfaces at a nominal coverage rate of 8 m^2 per litre. Care shall be taken to obtain an even film with no runs or sags. Only those areas that are to be wrapped the same day shall be primed. If primed areas are to be left overnight, these areas shall be re-primed before wrapping.

c) Tape Wrapping:

The joint shall be spirally wrapped (minimum 55% overlap) with "Denso Acrylic Tape" (or approved equivalent) in accordance with the manufacturer's requirements such that the start and end points are located at buried sections of the pipe, before it daylights. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. It is important that tension in the tape be released when the wrapping of the last half circumference of the pipe.

d) Final Coating:

One coat of “Densoflex Fire Retardant” shall be applied to the exposed pipe at a nominal application rate of 3 m^2 per litre."

PSL 3.9.3.10 Repair of Cement Mortar Lining (New Sub-Clause)

Add new Sub-Clause:

Pipes with linings damaged prior to acceptance by the Contractor shall be marked and recorded by both the Contractor and the Employer’s Agent’s Representative and then repaired by the Contractor. The payment rate for repair shall be made at the scheduled rate. Once the Contractor has accepted pipes with undamaged linings from the Employer, any subsequent damage to the lining in the pipes shall be repaired by the Contractor at his expense.

All repair procedures shall be subject to the prior approval of the Employer’s Agent. Generally, a crack is to be ground out using a mechanical grinder down to the steel wall to form a “dove-tail” groove with a minimum width of 8 mm. Care must be taken not to grind any of the steel pipe wall. The groove shall be rendered free of laitance, dust, oil, grease, fractured aggregate and other deleterious matter. The steel pipe wall internal surface shall be rendered free of rust and other deleterious matter by wire brushing (apply white spirit if necessary). The groove shall be filled with “Epidermix 338” (or equivalent approved), mixed and applied in accordance with the procedure set out in PSL 3.9.3.3.

PSL 3.9.3.11 Repair of 3LPE Coating (Large Areas) (New Sub-Clause)

Add new Sub-Clause:

"A large area repair is defined as an area larger than 650 mm^2.

Pipes with external coatings damaged prior to acceptance by the Contractor shall be marked and recorded by both the Contractor and the Employer’s Agent’s Representative and then repaired by the Contractor. The payment rate for repair shall be made at the scheduled rate.

All damaged and blistered FBMDPE coating caused by welding or other mechanical means shall be removed back to sound coating by mechanical grinding or other approved means.

The exposed steel surface shall be power wire brushed to remove dirt, scale, rust and other foreign matter to a surface profile equivalent to a Class St 2 finish. Weld spatter shall be removed by chipping or grinding to a smooth surface flush with the surrounding steel. Welds shall have a smooth contour free from sharp edges, protrusions and undercut. Sharp edges and protrusions shall be removed by grinding to a smooth radius of curvature of not less than 3 mm.

Degreasing of the exposed steel surface shall be done in terms of Clause PSL 3.9.3.1.

The surrounding sound FBMDPE surface shall be feathered from steel surface to maximum thickness and then abraded to a distance of 100 mm beyond the defective area. The abrasion shall be carried out with clean emery paper of 80 to 100 mesh so as to produce a suitably rough surface profile without causing the removal of excessive amounts of protective material. Virgin Sintakote powder is to be melted into the defect to ensure proper mechanical bonding with the steel surface and chemical bonding with the existing Sintakote. The melting of the virgin material shall be such that melting is not effected with an open flame. The melted powder shall be shaped with a hot spatula to form a smooth surface over the repair area.

Under no circumstances will patching of damaged areas by means of pieces of tape wrap, be allowed."

PSL 3.9.3.12 Repair of 3LPE Coating (Small Areas) (New Sub-Clause)

Add new Sub-Clause:

"A small area repair is defined as an area less than 650 mm^2.

A small area repair is effected by means of the application of a hot spatula to repair the defect, provided that there is a residual layer of polyethylene adhering strongly to the steel surface. Alternatively, virgin Sintakote powder material may be melted with heated spatula over the damaged area, to fill the mechanical damages in the coating and fuse with the surrounding coating material, all as per the manufacturer's recommendations.

At each pinhole detected by the Holiday test, the surrounding area shall be abraded to 25mm beyond the defective area. The abrasion shall be carried out with clean emery paper of 80 to 100 mesh so as to provide a suitably rough surface profile without causing the removal of excessive amounts of coating material. A hot spatula shall be utilized to work Sintakote into the pinhole defects. It is noted

that any cluster of pinholes within a radius of 25mm shall be regarded as one defect."

PSL 3.9.3.13 Repair of Three Layer Polyethylene Coatings (New Sub-Clause)

Add new Sub-Clause:

Pipes with linings damaged prior to acceptance by the Contractor shall be marked and recorded by both the Contractor and the Employer's Agent's Representative and then repaired by the Contractor. The payment rate for repair shall be made at the scheduled rate. All making good of the exterior coatings at damaged areas that is required to ensure continuous corrosion protection to steel surfaces shall be carried out strictly in accordance with an approved method statement that is to be prepared by the Contractor.

The basic requirements are the careful cut back of the outer sleeve and removal of the residual adhesive layer. The exposed surfaces are to be prepared as specified in PSL3.9.3.1 and this is to be followed by the application of an approved epoxy material followed by the application of a shrink sleeve covering the whole of the affected area with an overlap of no less than 50 mm.

The epoxy material shall be sufficiently thixotropic that 500 micrometres dry film thickness can be achieved in one application without sagging.

After curing, the repaired section and at least 250 mm of the surrounding area, shall be tested for electrical insulation defects as specified elsewhere. There shall be no electrical insulation defects.

PSL (A1) Repair of 3LPE Coating and Cement Mortar Lining for 200mm ND Pipes

This item covers the repair of external **3-Layer Polyethylene (3LPE) coating** and internal **cement mortar lining (CML)** on steel pipes as specified and measured in the Bill of Quantities (typically over a 1 m length per repair section).

Specification Requirements:

The rate provided by the Contractor for this item shall be **all-inclusive**, covering the full extent of the work necessary to restore the pipe's protective systems to their original condition and performance standard. This shall include, but not be limited to, the following:

1. **External Coating Repair (3LPE):**
    - Complete removal of the existing 3LPE coating, where deemed necessary, over the measured repair length (approximately 1 m or as directed by the Engineer).
    - Surface preparation in accordance with **ISO 8501-1** or equivalent, achieving a minimum surface cleanliness of **Sa 2½**.
    - Reinstatement of the external coating using a compatible **3LPE system** in accordance with the **specialist supplier's repair procedure** and relevant **API 5L / API RP 2202** specifications.
    - The reinstated coating shall achieve a uniform thickness, adhesion, and performance equivalent to the original factory-applied coating.
2. **Internal Lining Repair (Cement Mortar Lining):**
    - Removal of defective or damaged internal cement mortar lining along the corresponding repair section.
    - Surface cleaning and preparation of the exposed steel to remove contaminants prior to relining.
    - Reinstatement of the cement mortar lining to the specified **thickness** appropriate for the **pipe diameter**, using a mix design conforming to **SANS 1215** or equivalent standard.
    - Curing and finishing shall ensure a dense, smooth, and continuous lining surface free from cracks, voids, or disbondment.

3. **General Requirements:**
    - All materials, tools, and workmanship shall conform to the coating and lining manufacturer's recommendations and applicable **API** and **SANS** specifications.
    - The rate shall include all costs for materials, labour, tools, testing, inspection, surface preparation, and protection of adjacent coatings or linings during the repair process.
    - Repaired sections shall be inspected and approved by the Engineer prior to backfilling or recommissioning.

PSL (A2) **Repair of 3LPE Coating and Cement Mortar Lining for 300mm ND Pipes**

This item covers the repair of external **3-Layer Polyethylene (3LPE) coating** and internal **cement mortar lining (CML)** on steel pipes as specified and measured in the Bill of Quantities (typically over a 1 m length per repair section).

Specification Requirements:

The rate provided by the Contractor for this item shall be **all-inclusive**, covering the full extent of the work necessary to restore the pipe's protective systems to their original condition and performance standard. This shall include, but not be limited to, the following:

1. **External Coating Repair (3LPE):**
    - Complete removal of the existing 3LPE coating, where deemed necessary, over the measured repair length (approximately 1 m or as directed by the Engineer).
    - Surface preparation in accordance with **ISO 8501-1** or equivalent, achieving a minimum surface cleanliness of **Sa 2½**.
    - Reinstatement of the external coating using a compatible **3LPE system** in accordance with the **specialist supplier's repair procedure** and relevant **API 5L / API RP 2202** specifications.
    - The reinstated coating shall achieve a uniform thickness, adhesion, and performance equivalent to the original factory-applied coating.
2. **Internal Lining Repair (Cement Mortar Lining):**
    - Removal of defective or damaged internal cement mortar lining along the corresponding repair section.
    - Surface cleaning and preparation of the exposed steel to remove contaminants prior to relining.
    - Reinstatement of the cement mortar lining to the specified **thickness** appropriate for the **pipe diameter**, using a mix design conforming to **SANS 1215** or equivalent standard.
    - Curing and finishing shall ensure a dense, smooth, and continuous lining surface free from cracks, voids, or disbondment.
3. **General Requirements:**
    - All materials, tools, and workmanship shall conform to the coating and lining manufacturer's recommendations and applicable **API** and **SANS** specifications.
    - The rate shall include all costs for materials, labour, tools, testing, inspection, surface preparation, and protection of adjacent coatings or linings during the repair process.
    - Repaired sections shall be inspected and approved by the Engineer prior to backfilling or recommissioning.

PSL (A3) Repair of 3LPE Coating and Cement Mortar Lining for 350mm ND Pipes

This item covers the repair of external **3-Layer Polyethylene (3LPE) coating** and internal **cement mortar lining (CML)** on steel pipes as specified and measured in the Bill of Quantities (typically over a 1 m length per repair section).

Specification Requirements:

The rate provided by the Contractor for this item shall be **all-inclusive**, covering the full extent of the work necessary to restore the pipe's protective systems to their original condition and performance standard. This shall include, but not be limited to, the following:

1. **External Coating Repair (3LPE):**
    - Complete removal of the existing 3LPE coating, where deemed necessary, over the measured repair length (approximately 1 m or as directed by the Engineer).
    - Surface preparation in accordance with **ISO 8501-1** or equivalent, achieving a minimum surface cleanliness of **Sa 2½**.
    - Reinstatement of the external coating using a compatible **3LPE system** in accordance with the **specialist supplier's repair procedure** and relevant **API 5L / API RP 2202** specifications.
    - The reinstated coating shall achieve a uniform thickness, adhesion, and performance equivalent to the original factory-applied coating.
2. **Internal Lining Repair (Cement Mortar Lining):**
    - Removal of defective or damaged internal cement mortar lining along the corresponding repair section.
    - Surface cleaning and preparation of the exposed steel to remove contaminants prior to relining.
    - Reinstatement of the cement mortar lining to the specified **thickness** appropriate for the **pipe diameter**, using a mix design conforming to **SANS 1215** or equivalent standard.
    - Curing and finishing shall ensure a dense, smooth, and continuous lining surface free from cracks, voids, or disbondment.
3. **General Requirements:**
    - All materials, tools, and workmanship shall conform to the coating and lining manufacturer's recommendations and applicable **API** and **SANS** specifications.
    - The rate shall include all costs for materials, labour, tools, testing, inspection, surface preparation, and protection of adjacent coatings or linings during the repair process.
    - Repaired sections shall be inspected and approved by the Engineer prior to backfilling or recommissioning.

PSL Corrosion Protection of Valves and & Flexible and Flanged Joints (New Sub-Clause) 3.9.3.15

Add new Sub-Clause:

"Every buried cast iron/steel coupling, joint, flange, and valve, where scheduled, shall be protected by the following "Denso" or equal approved anti-corrosion system:

After the pipework has been satisfactorily tested (and bonded at the couplings for electrical continuity if applicable) the exposed portion of the coupling, joint or flange and the unsheathed portions of the

pipes at the joint and the bodies of all buried valves are to be covered with an approved petroleum based mastic/cloth system applied strictly in accordance with the manufacturer's instructions and then covered with two layers of approved adhesive PVC tape. The external sheathing system, which shall be to the approval of the Employer's Agent, shall be carried out as follows:

All loose dirt, rust, mill scale and flaking paint shall be removed by wire brushing all exposed metal surfaces. An approved priming solution shall be applied by brush with care being taken to ensure all exposed metal surfaces are coated.

"Denso", "Corromastic" or equal approved mastic is to be packed around the joint and/or valve body to form an even contour for the application of tape. A fillet is to be formed between the flange and the pipe barrel/valve body, and, in the case of flexible couplings, mastic is to be packed around the bolts to a height of 3 mm above the bolts. Care must be taken to ensure that no air is entrapped.

A layer of impregnated tape/cloth is to be spirally applied with a minimum overlap of 50 mm. All air pockets are to be removed.

A 10 mm thick layer of mastic is then to be packed on top of the tape and a second layer of impregnated tape/cloth is to be spirally applied with a minimum overlap of 25 mm. The tape layer is to commence and terminate at least 100 mm over the pipe sheathing on either side of the joint. The surface is then to be smoothed off and all air pockets are to be removed.

An overwrap consisting of two separate layers of approved, 300 micron thick adhesive PVC tape is to be spirally applied with a minimum of 25 mm overlap and with at least two laps over the untreated sheathing on either side of the joint.

The whole sheathed area of the joint is to be subjected to holiday detection and, if proved sound and approved by the Employer's Agent, may be covered with "padding" sand."

PSL 3.9.3.16 **Payment for Inspection and Testing**

Repairs by the Contractor will be subject to inspection by the Employer's Agent and the Employer's Third-Party inspection agent. Should additional expenditure be incurred by the Employer's inspector, due to any failure of the prescribed tests, then such additional expenditure shall be reimbursed to the Employer by the Contractor and shall be deductible from the Payment Certificates.

PSL 3.10 Valves

Delete the Sub-Clause and substitute:

"Valves supplied under this Contract shall comply with the requirements of Particular Specification
PA: Valves which covers Gate Valves, Resilient Seal Valves, Butterfly Valves, Reflux valves and Air Valves."

PSL 3.11 Manholes and Surface Boxes

PSL 3.11.1 Bricks

Delete the first sentence and substitute:

"Bricks for manholes and surface boxes shall be engineering bricks type FBXE45 or better, with a water absorption not exceeding 7% and complying with the applicable requirements of SANS 227."

PSL 3.11.5.1 Manhole Covers and Frames

Delete the Sub-Clause and substitute:

"Manhole covers shall comply with SANS 558 for the types shown on the drawings and/or scheduled in the Bills of Quantities."

PSL 3.11.6 Sand

Add new Sub-Clause:

"Sand used for mortar (general purpose) and for plaster (external) shall comply with the applicable requirements of SANS 1090."

PSL 3.11.7 Cement

Add new Sub-Clause:

The cement used on the Works shall be Portland cement complying with the requirements of SANS 50197-1 and -2: Common Cements.

PSL 4 PLANT

PSL 4.4 Packing (New Sub-Clause)

Add new Sub-Clause:

"Goods should be suitably packed in such manner as will ensure safe and efficient transport by road or rail, and the Contractor shall include in his prices for whatever packing may be necessary in this respect. Small items particularly liable to damage or loss in transit should be crated. All crates and packing material shall, after use, become the property of the Employer, unless distinctly specified otherwise, or if returnable, shall be so at the Contractor's expense."

PSL 4.5 Protection of Linings during Transportation (New Sub-Clause)

Add new Sub-Clause:

"The ends of every pipe, fitting and special shall be fitted with suitable end closures as a precautionary measure against damage being caused to the lining material. The end closures shall be capable of preventing the ingress of dirt and at the same time allowing air to ventilate through the pipework which they protect but without drying the linings out (in the case of cement mortar lined pipes) so as to cause them to crack. They shall be secured in such a manner that they cannot be dislodged or damaged by normal pipe handling operations."

PSL 4.6 Marking (New Sub-Clause)

Add new Sub-Clause:

"Every bend shall be marked as stated in PSL 3.4.1 above and, in addition, shall have its deflection angle in degrees and minutes painted on the outer surface.

Packaged items such as nuts and bolts, insertion rings etc shall be marked with a metal label bearing the Contract No and the Schedule Item No. with which they are to be used."

PSL 4.7 Advice Notes and Invoices (New Sub-Clause)

Add new Sub-Clause:

"The Contractor shall submit one copy of every advice note in respect of each individual consignment, quoting the Contract Number, the truck or vehicle number, item numbers and a brief description of the articles so consigned. The advice note shall be lodged with the Employer's Agent 's Representative on Site at least two days before the arrival of the goods."

PSL 4.8 Delivery and Acceptance (New Sub-Clause)

Add new Sub-Clause:

"The material to be supplied under this Contract shall be consigned and delivered to approved areas adjacent to the pipeline route, or to an approved storage area if not required for immediate use."

PSL 5 CONSTRUCTION

PSL 5.1 LAYING

PSL 5.1.1 General

Add to the Sub-Clause:

"The Contractor will be responsible for clearing the areas required for pipe storage that shall include the removal of rock, stones and all combustible material. He/she shall also be responsible for maintaining the area in a clean and tidy condition for the duration of the Contract.

Upon delivery of the pipes, fittings, specials and valves, these will be inspected jointly by the Employer's Agent 's Representative and the Contractor. Any items found to be damaged shall be returned to the factory for repair or replacement, in which case the costs of additional transport, repair or replacement shall be borne by the Contractor if the pies were supplied by the Contractor and not by the Employer.

The Contractor will be held fully responsible for the care and safety of all pipes and fittings, etc, on site, and shall bear the cost of all renewals, which may be necessary to make good losses, damages or breakages. Furthermore, he shall be fully responsible for handling and re-loading material at the storage areas and for transporting and offloading of all such materials to the Site of the Works.

Before commencing pipelaying, the Contractor shall properly distribute pipes, fittings and specials, along the trenches. Valves and couplings shall not be distributed until they are actually required for laying in their designed position."

PSL 5.1.1.1 Inspection, Detection and Repair of Holidays (New Sub-Clause)

Add new Sub-Clause:

"Complete sets of transistorised portable holiday detection equipment with adjustable output voltage with interchangeable 200 mm brush and full circle electrodes, adaptable for use on damp or dry surfaces of coatings of pipes, buried valve bodies, fittings and couplings of any diameter in the range DN 200 to DN 700 are to be provided, tested, maintained and recharged when necessary by the Contractor at the rates quoted in the appropriate items in the Bills of Quantities, for use by the Employer's Agent Representative in inspecting coatings, wrappings and external protection of pipes, valves, fittings and couplings at the site of the Works and/or the point of delivery in accordance with the following:

When laying of pipes or fittings or covering of pipes, buried valve bodies, fittings or couplings with padding or concrete is proceeding in more than one 250 metre long section of the working strip on any day, the Contractor shall provide a sufficient number of complete sets of holiday detection equipment in addition to the holiday detection equipment required by his own staff to permit the person appointed by the Employer's Agent to carry out holiday inspections simultaneously at each such section of the working strip.

The Contractor shall include in his tendered price for the appropriate item in the Bills of Quantities an allowance to cover the provision by him of all extra labour and equipment necessary for all special handling of pipes, valves and fittings which is required in order to facilitate the following standard holiday detection operations which will be carried out by the Employer's Agent or his Representative.

During laying operations the full circle electrode of the holiday detector will be passed over all the external surface of each pipe, except such area as may be covered by a belt sling or other approved handling tackle not exceeding 600 millimetres in total width used for supporting the pipe in the course of the laying operation immediately prior to lowering the pipe into its trench. Only if a holiday is detected in the course of the inspection described above, will the entire external surface of the pipe have to be inspected by passing the full circle electrode of the holiday detector over the full length of the pipe. At the laying site the holiday detection equipment will also be used to check the external coating of fittings before laying and to check completion of external coatings over welded joints or couplings after hydraulic pressure testing of the pipeline.

The Contractor shall so carry out his laying work as to provide reasonable time and access to the Employer's Agent for the purpose of the inspections described above. The tendered rates for pipework shall be deemed to include for all holiday detection described in this Specification.

All work ordered by the Employer's Agent in writing to be carried out by the Contractor in assisting in any holiday detection inspection which the Employer's Agent may carry out in addition to the standard operations described above and proving of repairs mentioned below shall be carried out by the Contractor at agreed rates.

All holidays, voids, pinholes or other flaws in the coatings or wrapping or completed external covering to welds, couplings or buried valve bodies are to be made good by the Contractor at his expense.

Protective coating or wrapping to pipes and fittings or completed external covering to joints and buried valve bodies which are inadequately bonded, damaged by abrasion, below the minimum thickness, do not comply with the materials specifications and are in any other manner defective must be removed and replaced at the expense of the Contractor. All pinholes and other defects located by means of the holiday detector shall be repaired to the satisfaction of the Employer's Agent and proved sound by the holiday detector.

The coating of each pipe shall be inspected and holiday detected by the Contractor, immediately prior to being laid and these inspections will be witnessed and signed off by the Employer's Agent or an appointed third-party inspection authority. Two thirds of the circumference of each pipe and fitting will be inspected outside the trench, after the pipe/fitting has been transported to the construction site where it is to be laid. This inspection is to be carried out shortly before each pipe is hoisted for laying in the trench. The balance of the circumference of each pipe/fitting will be inspected once the pipe/fitting has been laid in the trench. This will require the pie/fitting to be rotated to facilitate inspections.

All remedial work that is required shall be effected immediately upon detection of any holidays. The cost of holiday testing and effecting remedial work to the coating of the pipe at the installation location, as a result of construction or transportation or storage damage, shall be deemed to be included in the tendered rates for the laying of the pipe/fitting.

Each and every external coating make good at welded joints, shall be holiday tested around the full circumference and be subject to approval of in terms of the relevant Quality Control Procedure. All costs associated with holiday detection and any costs of effecting remedial work, shall be deemed to be included in the tendered rates i.e. no special or "extra over" payments will be made for external repairs or make goods at joints.

All pipe specials being corrosion protected with an external epoxy coating, shall be holiday tested before being incorporated into the works as well as holiday tested after inclusion into the works. All the costs of holiday detection and any costs for effecting remedial work shall be deemed to be included in the rates for the laying of the pipe/fitting.

The corrosion protection systems on all fittings and manufactured specials shall be holiday tested once included into the permanent works. All the costs of holiday detection and any costs of effecting remedial work shall be deemed to be included in the tendered rates for the laying of the pipeline.

The appropriate wet sponge tests shall be conducted on the internal surfaces of all epoxy linings, and particularly on reinstated areas and make good at joints, and on manufactured specials and repairs to linings. This will be carried out from time to time and again before final cleaning of sections of the pipeline that are completed. All the costs associated with wet sponge holiday detection and any costs for effecting remedial work shall be deemed to be included in the rates for the laying of the pipeline.

Should the Contractor feel that some of the holidays detected in the lining, are as a result of the original manufacturing process, this should be brought to the Employer's Agent's attention for evaluation. The Employer's Agent's decision in this regard will be final and, should it be decided that the holidays are in fact as a result of the manufacturing process, the Contractor will be required to repair the same at his own cost.

PSL 5.1.2 Damage

Add to the Sub-Clause:

"The Contractor shall be responsible for protecting pipes fittings and valves from grass fires at all times and shall keep grass cut short in the vicinity of all unlaid pipework items.

Should trenches be inundated by water, there is a risk of movement of the pipes by flotation. The Contractor shall ensure that trenches are not flooded by stormwater and that pipes laid in the trench are backfilled as soon as possible after laying, except at joints made with couplings or flanges which must be kept visible until the pipeline has been satisfactorily tested.

Steel pipes with welded joints may, after all specified testing and corrosion protection has been satisfactorily completed and with prior approval from the Employer's Agent, be backfilled at the same time as backfilling the pipeline.

Should movement of the pipes occur, the Contractor shall remove the pipes from the trench and thoroughly clean and relay the pipes. This work shall be carried out at the Contractor's expense."

PSL 5.1.3 Keeping Pipelines Clean

Add to the sub-clause:

"The Contractor shall take all of the steps necessary to prevent flooding of the Works and hence ensure that all work is carried out in the dry, and that the ingress of dirt and or dirty water into the pipes is prevented. The ends of all laid pipes must be closed at all time when work is not being carried out."

PSL 5.1.3.1 Cleaning Pipe Internals (New Sub-Clause)

Add new Sub-Clause:

"The Contractor shall ensure that all pipe work is installed internally free of any contaminants. All traces of dirty water, slag, splatter, swarf, cuttings, coupons, welding rod ends, grinding dust, dirt and other debris are to be removed from the inside of the pipe as it is installed.

The Contractor's attention is drawn to the need to take great care to protect internal epoxy linings. To this end, a rubber mat is to be provided for walking on inside the pipe. On steep slopes, the mat is to be restrained from sliding down the pipe. Care must also be taken on steep slopes to restrain equipment and hand tools from sliding down the pipe during construction.

The relevant safety procedures are to be followed when entering pipes.

The Contractor shall ensure that all dust, grit and powder that accumulates in the pipe as a result of grit blasting for the repair of internal linings, be removed from the pipe in an acceptable manner before the internal lining repairs are carried out.

Once the lining repair has been completed, cleaned off and inspected, that specific section of the pipe shall be blocked off to prevent any further access by workers.

The Contractor shall take note that flushing of the completed pipeline may not be allowed after construction has been completed and therefore clean house keeping practices will be required under all circumstances during construction. The tendered rates for pipe laying shall include for the clean house keeping practices required.

Each section of the pipeline is to be internally inspected and passed by the Employer's Agent once construction has been completed. If the pipework is not satisfactory, the Contractor shall re clean the pipe at his own expense until the pipe is passed clean. The Employer's Agent reserves the right to utilize cameras or any other means to inspect inaccessible areas."

PSL 5.1.3.2 Cleaning of Valves and Fittings (New Sub-Clause)

Add new Sub-Clause:

"All flanges, valves, fittings and equipment may only be installed in pipe work after they have been thoroughly cleaned. Flange faces shall be checked for damage before being incorporated into the permanent works and any damage shall be reported to the Employer's Agent."

PSL 5.1.4 Depths and Cover

Delete Sub-Clause 5.1.4.1 and substitute the following:

"Unless otherwise shown on the drawings or scheduled in the Bills of Quantities or ordered, the depth of excavation for trenches for medium-pressure pipelines shall be such that the cover to finished ground level over the laid pipe shall not exceed 1,0 m."

Delete from the third and fourth lines of Sub-Clause 5.1.4.2:

PSL 5.1.5 Working Inside Pipes and Protection of Internal Linings (New Sub-Clause)

Add new Sub-Clause:

"All possible care shall be exercised during construction in order to avoid damage being inflicted to the pipe lining as a result of the installation and welding activities, and the following procedures shall be adopted at all times:

- Placing of rubber protection mats in the pipeline to ensure that no damage occurs as a result of foot traffic, falling tools and equipment, weld splatter and or grinding spray.
- Labourers working inside the pipe are to wear soft soled shoes.
- Wet sacking or rubber matting shall be placed on the pipe invert in the areas where welding or flame cutting operations are in progress to minimise the extent of damage to the lining from weld splatter or molten metal from flame cutting. This requirement shall be strictly enforced.
- Tools shall be placed on rubber foam or resilient rubber matting to protect the epoxy pipelining against mechanical damages.
- Particular care is to be taken inside the pipe when tie ins into the pipe is done for the purpose of fitting air valves, scour valves, by passes and other tie ins.
- Once internal work in a specific pipe section has been completed and the pipe has been successfully cleaned, holiday detected and approved as being constructed to the satisfaction of the Employer's Agent, the Contractor shall block off that section of pipe to prevent any further man entry into same.

- The rates tendered in the Bills of Quantities shall include for all the measures required under this clause.

Detection of holidays in the internal epoxy lining will only commence once all internal activities in the pipeline have been completed. That is welding of joints, preparation of joints for epoxy reinstatement, as well as epoxy reinstatement in terms of the requirements of this specification. This excludes repair of epoxy lining as a result of damage incurred before the pipe is transported to the construction site as these defects will be repaired in the pipe yard.

Once all work is complete in a particular length of pipe, the Contractor shall arrange for the pipe to be thoroughly swept of all dust and debris. The pipelining and joint repair will then be tested with a

"wet sponge" detector set at 90 Volts in order to detect any electrical insulation defects."

PSL 5.1.6 Equipment for Inspecting Internal Surfaces of Pipes (New Sub-Clause)

Add new Sub-Clause:

"The Contractor shall make the following equipment available for use by the Employer's Agent for the inspection of the internal surfaces of the pipes DN 700 and larger:

- One pair of boots having leather uppers and rubber soles
- One one-piece overall with at least one breast pocket
- One adjustable safety harness
- Two screw drivers, 5 cm and 10 cm long
- One small peen hammer
- A two-cell torch with a 10W light bulb with two sets of rechargeable batteries and a battery charger and spare bulbs
- A sufficient length of 16 mm diameter rope to suit the conditions on site.
- One trolley suitable for inspecting pipes of the appropriate diameter(s).

The equipment shall be kept in good condition and operating order throughout the duration of the Contract. No separate payment will be made for this equipment and the costs therefore will be deemed to be included in the tendered rates."

PSL 5.1.7 Pipe Support (New Sub-Clause)

Add new Sub-Clause:

"Temporary pipe supports may be used to assist setting up and assembly. However, it is preferred that permanent pipe supports are installed as soon

as possible to minimize double handling and/or omission during construction.

Permanent pipe supports shall be constructed as indicated on the drawings or as directed on site.

Before testing, all permanent supports shall be complete and all temporary supports removed, unless otherwise agreed by the Employer's Agent."

PSL 5.1.8 End Caps (New Sub-Clause)

Add new Sub-Clause:

"The Contractor shall, at the end of each day's work, fit end caps to the open ends of the pipeline under construction. The end caps shall be manufactured in such a manner that it can be fitted to seal off the pipeline to the extent that it is totally dust and waterproof. The end cap shall be able to withstand a pressure of 5 m head of water externally when fitted.

End caps shall be maintained during non-working periods.

The tendered rates for the laying of pipe shall be deemed to include for the supply, fitment, and maintenance of the end caps."

PSL 5.1.9 Marker Posts (New sub-Clause)

Add new Sub-Clause:

"Pre-cast concrete marker posts as shown on the drawings and painted white in colour shall be set at all horizontal direction changes and where otherwise indicated by the Employer's Agent.

The standard marker post rate shall include the supply and erection of painted, inscribed posts. The rate shall be inclusive of erection and shall include for all necessary excavation, mass concrete footing and formwork."

PSL 5.2 JOINTING METHODS

PSL 5.2.2 Flanges (Steel Pipelines)

In the heading delete **"(Steel Pipelines)"**

Add to the Sub-Clause:

"Before being brought together, the ends of the pipes, fittings, couplings and flanges are to be inspected and cleaned to ensure that all parts forming the joint are undamaged and clean.

When jointing flanges, the faces shall be cleaned thoroughly and approved jointing material (compressed asbestos cement fibre or other approved gaskets on flanged joints), cut properly to size, is to be inserted immediately before bringing the two flanges together. Before closing the joints, the flanges must be parallel to each other, with all bolts inserted in the bolt holes. After the fittings have thus been aligned and well supported, the joint shall be bolted up to a uniform tightness using torque wrenches to achieve the required compression force on the gasket.

If and where full-face gaskets are used, the jointing material shall be flush with, or protrude beyond, the outer circumference of the flange (this in not applicable to raised face flanges). On completion of the joint, the flanges and bolts shall be protected as described in Clause PSL 3.9.3.8."

PSL 5.2.3 Welding (Steel Pipelines DN 300)

Delete the title and replace with **“Welding (Steel Pipelines)”**.

Delete the 1st sentence and replace with:

"Field and shop welding of steel pipes, bends and fittings shall be carried out in accordance with the relevant requirements of the latest version of API 1104. Prior to commencement of welding, the Contractor shall produce a qualified welding procedure in accordance with the latest version of API 1104, for the intended sizes, processes, positions, and consumables to be used on the project.

Welding shall be carried out by welders who are competent in terms of the procedure approval test given in API 1104. Prior to commencement of welding, the current qualification of each welder must be produced in accordance with the welding procedure. Should constant repairs be required on welds carried out by one particular welder, the Employer’s Agent may require that the welder be re-tested or removed from the project."

Add to the Sub-clause:

PSL 5.2.3.1 Radiographic Examination of Shop Welds: (New Sub-Clause)

The Contractor shall include in his prices for the manufacture of bends, fittings and specials for the cost of carrying out, under the supervision of an inspector appointed by the Employer's Agent or Employer, examination of shop welds on the following basis:

a) Field Welds:

Radiographic testing will be performed on butt welds and dye penetrant testing on fillet welds. All welds will be tested and adjudicated in accordance with API 1104. Radiographic testing of butt welds is to be carried out on 100% of the welds.

Repairs of welds will be permitted in accordance with approved repair procedures. Repairs shall be re-examined using the relevant non-destructive testing method. All costs associated with the repair of defective welds will be borne by the Contractor.

b) Fabrication of Bends, Fittings and Specials

i) ONE HUNDRED percent radiographic examination of all weld deposited manually or semi-automatically in bends, fittings and specials which cannot be hydraulically tested because they have a plain end.

ii) TEN percent radiographic examination of all welds deposited manually or semi automatically in all flanged bends, fittings, and specials which are to be tested hydraulically.

All radiographs and records thereof shall be made available to the Employer's Agent to enable him to determine whether the welds are acceptable or not and no lining or wrapping of pipes, bends or fittings shall be permitted until the welds have been accepted by the Employer's Agent.

The Contractor must submit a Quality Control plan indicating the inspection point. The Contractor is allowed one inspection once a week for items not manufactured on site.

When a section of the weld is shown by radiography to be unacceptable and, if the limits of the deficient weld are not defined by the radiograph, additional radiography shall be carried out at the Contractor's expense until the limits of the deficiency are determined.

Repairs shall be made to defective welds at the Contractor's expense. All repair welds shall be identified with a stamp marking, indicating which welder conducted the repair. Repaired welds shall be radiographed at the Contractor's expense but, after any repair welder has had ten consecutive repairs approved, the extent of the radiography of the repairs conducted by the welder may be

decreased by agreement between the Employer's Agent and the Contractor."

PSL 5.2.3.2 Welding Procedure (New Sub-Clause)

Add new Sub-Clause:

"Welding shall, unless otherwise prescribed in the approved welding procedure, commence at the top of the joint and proceed downwards. In addition to the root weld, at least two further passes shall be made, none of which is to exceed 3 mm in depth but this is subject to the approved welding procedure."

PSL 5.2.3.3 Aligning (New Sub-Clause)

Add new Sub-Clause:

"The alignment of abutting ends shall be such that the offset does not exceed 1,5 mm. Line-up clamps ("dogs") shall not be used for the "fit-ups". The use of "bridges and wedges" or any other method that may reduce the pipe wall thickness when removed or in any way introduce unnecessary stresses into the pipe is forbidden."

PSL 5.2.3.4 Weather Conditions (New Sub-Clause)

Add new Sub-Clause:

"Welding shall not be performed under conditions that could affect the quality of the welded joint
(e.g. high moisture or windy conditions). Windshields may be used where practical."

PSL 5.2.3.5 Clearance (New Sub-Clause)

Add new Sub-Clause:

"The minimum clearance around the pipe during welding shall be 500 mm or such other minimum distance that may be required to facilitate compliance with the approved welding procedure. When welding in the trench, adequately sized "fox holes" shall be excavated/formed so as to provide adequate access for the welders."

PSL 5.2.3.6 Visual Inspection (New Sub-Clause)

Add new Sub-Clause:

"100% of each joint will be examined and the following criteria shall be met:

All welds shall be substantially uniform in appearance with the inner and outer weld beads not exceeding 1 mm and 3 mm in height respectively unless otherwise required in terms of the approved welding procedure.

Undercut will not be permitted under any circumstances.

The weld, heat affected zone, and surrounding parent metal shall be free from cracks, porosity and trapped slag.

All weld splatters must be removed prior to corrosion protection application."

PSL 5.2.3.6 Non-Destructive Testing After Construction (New Sub-Clause)

Add new Sub-Clause:

"The Employer's Cathodic Protection Professional Services Provider will carry out coating integrity surveys along the full length of the pipeline as prescribed in the Employer's Cathodic Protection Specification.

Any defect(s) found in the pipeline coating, as a result of the PCM or DCVG testing shall be located and repaired by the Contractor at his expense.

In the case of PCM testing, all coating defects identified with an area greater than 0,5 square centimetre per 12 metre length of pipeline shall be located and repaired.

In the case of DCVG surveys, all coating defects identified with a value greater than 3% IR (or such other value as may be determined and agreed following analyses of the results of the first section which undergoes DCVG testing) shall be located and repaired. The agreement between the Contractor and the Employer's Agent on this baseline, will be set as the criteria for the coating repair requirements by the Contractor on the whole pipeline.

Depending on the extent of the defects identified during PCM or DCVG testing, the Employer's Agent may call for a further survey after the initial defects have been repaired by the Contractor, the cost of which testing shall then be borne by the Contractor.

PSL 5.2.3.7 Quality Control (New Sub-Clause)

Add new Sub-Clause:

"Records of which welds were carried out by each individual welder as well as non-destructive testing results shall be submitted to the Employer's Agent monthly. Should there be repetitive or serious defects, this information shall be forwarded to the Employer's Agent immediately."

PSL 5.2.4 Cut Pipes (New Sub-Clause)

Add new Sub-clause:

"Cut pipes shall be used where required as closure lengths. The cut ends shall be dressed square and to a smooth even finish and prepared for butt welding preparation which shall not be inferior to that of the ends of uncut pipes. The finished dimensions of ends cut on site must be within the tolerances applicable to the ends of the particular types of pipes to be laid. The cost of cutting and trimming of pipes shall be included in the rates tendered for laying and jointing pipes."

PSL 5.3 Setting Valves, Specials and Fittings

Add to the Sub-Clause:

"Valves are to be set correctly in the positions indicated and supported on concrete stools, except where not so required by the Employer's Agent. Valve spindle guide brackets and stays where provided shall be secured into position against concrete work and set and carefully adjusted in order to give true vertical alignment of the spindle."

PSL 5.4 Concrete Casing

In the first and second lines delete "a strength 15 MPa/37,5 mm or such other strength as scheduled" and substitute:

"concrete grade 20/19".

PSL 5.5 ANCHOR/THRUST BLOCKS AND PEDESTALS

In the fourth line delete " 15 MPa/37,5 mm " and replace with "20/19".

Add to the sub-clause:

"Steel pipelines that are to be continuously welded or flanged, do not require anchor/thrust blocks at tees, bends, terminal valves and end caps."

PSL 5.5 VALVE AND HYDRANT CHAMBERS

PSL 5.6.1 General

Delete the references to drawings L1, L2 and L3 and substitute "drawings issued by the Employer's Agent ".

PSL 5.6.2 Construction of Chambers

Delete the references to drawings L1, L2 and L3 and substitute "drawings issued by the Employer's Agent ".

PSL 5.10 DISINFECTION OF POTABLE WATER PIPELINES & RESERVOIRS

Delete the clause and replace with:

"The entire pipeline disinfection will be monitored by the Employer's Agent Representative and/or the Employer's personnel. The disinfection criteria are stringent and the Contractor shall keep the pipeline clean throughout the Contract.

The Contractor will be required to submit a detailed method statement for approval by the Employer's Agent. A minimum requirement will be that the method statement deals with the method of dosing and how the dosing rate will be controlled to ensure a uniform distribution throughout the pipeline being disinfected, the chemicals to be used, the anticipated range of dosing rates and equipment to be used, and the name and qualification the Contractor's person supervising the disinfection.

Once a successful hydraulic test of the entire pipeline has been achieved and the connections have been completed, the pipeline shall be drained. The pipeline shall then be re-charged in accordance with PSL 7.3.4 – "Initial Filling of the Pipeline". Whilst being charged, a sodium hypochlorite solution shall be dosed at a temporary connection(s) made at an air valve(s), which will be confirmed by the Employer's Agent in order to achieve a theoretical total chlorine concentration of 25 ppm (mg/l).

Once the entire pipeline has been filled in this manner, it shall be left for a 24-hour period. Thereafter, total chlorine concentrations shall be measured at each scour point. A concentration of 20ppm total

chlorine will be considered acceptable. Should this concentration not be achieved at all scours, the Contractor shall take all steps considered necessary by the Employer's Agent to achieve satisfactory disinfection, at his/her own cost.

Once satisfactory disinfection has been achieved, the pipeline shall be drained via the scour valves (or by other means approved by the Employer's Agent) and sufficient sodium thiosulphate (typically 1 part of total chlorine) shall be dosed into the scour-wet wells to fully neutralise the chlorine before discharging to watercourse.

The pipeline shall then be re-charged in accordance with the stated procedure and, after 24 hours, samples shall be taken and sent to an approved laboratory for analysis (at no cost to the Employer). Should the following limits not be achieved, the Contractor shall carry out at his/her own cost, all steps deemed necessary by the Employer's Agent to achieve satisfactory disinfection."

Water Quality Limits:

PARAMETER	COUNT
e. coli	0
Coliforms	0
Faecal Streptococci	0

sinfection of Pressed Steel Tanks

The Contractor shall disinfect the pressed steel tank in accordance with **SANS 241 (Drinking Water Standards)**, and good industry practice, prior to commissioning.

Methodology

1. **Cleaning & Preparation**
    - Remove all foreign material, dirt, oil, grease, and debris from the tank.
    - Rinse with clean water to ensure surfaces are free of construction residues.
2. **Filling & Chlorination**
    - Fill the tank with potable water to its full working capacity.
    - Apply a chlorine solution to achieve a **minimum free chlorine concentration of 50 mg/L (ppm)** throughout the tank.

- Ensure proper mixing to achieve uniform distribution of chlorine.

3. **Contact Period**

   - Maintain the chlorinated water in the tank for a **minimum of 24 hours**.
   - Free chlorine residual after 24 hours shall not be less than **25 mg/L**.

4. **Flushing**

   - After the contact period, drain the chlorinated water safely (in accordance with environmental regulations).
   - Thoroughly flush the tank and associated pipework with clean potable water until residual chlorine levels are less than **2 mg/L**.

5. **Testing & Verification**

   - Conduct bacteriological water quality tests (E. coli, total coliforms, etc.) from samples taken inside the tank.
   - Disinfection shall be deemed successful when test results confirm compliance with **SANS 241 drinking water standards**.

6. **Handover**

   - Submit a disinfection report indicating chlorine dosage, contact time, flushing details, and water test certificates before the tank is put into service.

PSL 6 TOLERANCES

PSL6.3 ALIGNMENT (PLAN AND LEVEL)

Delete the third and fourth line and substitute:
"of the pipeline, shall be + 50 mm + 10% and the permissible deviation per pipe length shall be +/- 20 mm."

Delete the sixth (last) line and substitute:
"+ 25 mm + 5% provided that there shall be no reversal of the pipeline gradient."

PSL 7.3 STANDARD HYDRAULIC PIPE TEST

Add the following preamble:

"Water used for one filling of the pipeline for hydraulic testing, one filling for disinfection and one filling after draining the disinfection water will be provided by the Employer free of charge. Additional water used due to dirty water in the pipe and/or due to unsuccessful hydraulic tests will be charged at the Employer's bulk rate per kilolitre that is charged to their bulk consumers. Filling of the pipeline for hydraulic testing shall be carried out slowly to enable air to escape and under the direction of the Employer's Agent.

Items have been provided in the Bills of Quantities to cover the costs of obtaining the water and conveying water from the supply point to the test section of pipeline.

PSL 7.3.1 Test Pressure and Time of Test

Add to the Sub-clause:

Pipeline sections shall be subjected to field test pressures as shown on the drawings.

The sections in which the pipeline may be tested will be at the discretion of the Contractor, except that the pipeline shall be tested in sections not exceeding a maximum allowable length of 2 000 m unless otherwise agreed by the Employer's Agent. The Contractor shall make due allowance in the construction programme and in the tendered rates for the entire testing operation including for the provision of temporary end stops (flanges or bullnoses) and any other costs incurred associated with testing the pipeline in intermediate sections. Once all intermediate sections have been successfully tested, the untested sections, if any, between the ends of the tested sections shall be visually inspected under working pressure.

The pipe shall not be tested until the associated structural concrete for anchorage has cured for 28 days or until such concrete has attained the specified design strength. Once filled, the pipe shall be left for 24 hours to permit maximum saturation of cement mortar linings.

The section to be tested shall be pressurised to the specified pressure and left for 24 hours, during which period, the pressure drop (if any) and the quantity of water required to be pumped in to restore the test pressure shall be measured and recorded. In addition, all flexible and flanged joints shall be visually inspected and there shall be no sign of leakage.

The permissible leakage for welded and flanged steel pipelines is zero (0) litres.

At all times when there is water in the pipeline, and particularly during filling, testing and draining of the pipeline, all air valves shall be in operation and their individual isolating valves shall be open."

PSL 7.3.1.2 Delete the Sub-Clauses 7.3.1.2

PSL 7.3.1.3 Delete the Sub-Clauses 7.3.1.3

PSL 7.3.1.4 Delete the Sub-Clauses 7.3.1.4

PSL 7.3.3 Permissible Leakage Rates (Sub-Clause 7.3.3)

Delete the title of Sub-Clause and substitute the following:

Permissible Make-up Water

Add additional paragraph to the Sub-Clause as follows:

"c) Welded steel pipelines ..... Nil"

PSL 7.3.4 Initial Filling of Pipeline (New Sub-Clause)

Add new Sub-Clause:

"The entire process for filling the pipeline at any time during testing or disinfection shall be carried out under the supervision of the Employer's Agent and will also be monitored by the Employer's Agent and/or the Employer's personnel. Under no circumstances will the Contractor be allowed to carry out filling of the pipeline without the supervision of the Employer's Agent, neither shall he/she permit any other persons to carry out such filling without the written permission of the Employer's Agent.

Any damage to the pipeline caused by non-compliance with this Sub-Cause shall be rectified at the Contractor's expense."

PSL 7.3.5 Connections after Testing (New Sub-Clause)

Add new Sub-clause:

"The connections of the new pipework to the existing pipework shall only be carried out after the pipeline testing has been completed and accepted by the Employer's Agent. For this

reason, testing must be carried out against a blank flange or bullnose end cap at these locations."

PSL 7.3.6 Remedial Measures (New Sub-Clause)

Add new Sub-clause:

"In the event that a pipe section fails a test, the Contractor shall carry out all remedial measures necessary to obtain a successful test of each individual section and the entire pipeline, at his/her own expense. Such remedial measures shall in no way compromise the original pipeline specifications."

PSL 7.3.7 Draining of the Pipeline (New Sub-Clause)

Add new Sub-clause:

"The pipeline may have to be drained to carry out remedial measures and it must be drained before the disinfection process commences. The pipeline shall be drained via the scour valves in a manner that does not cause erosion of the streambeds or negatively impact on the environment in any way. All such drainage of the pipeline shall be carried out under the supervision of the Employer's Agent's Representative."

PSL 7.6 Commissioning (New Sub-Clause)

Add new Sub-clause:

"The pipeline will be considered to have been commissioned and practically complete once all the associated structures are sufficiently complete to carry out their structural and hydraulic function and the hydraulic test and disinfection of the entire pipeline has been successfully completed."

PSL 8 MEASUREMENT AND PAYMENT

PSL 8.2.1 Collect from pipe yard, Lay and Bed Pipes Fittings, Specials and Couplings

Delete the sub-clause and substitute:

"Collect from pipe yard pipes, transport, lay, and bed pipes complete .....Unit: m or No

Collect from pipe yard pipes, transport, fabricate, install pipes, bends, fittings, valves, etc. Unit: Either per metre or 'extra over' the linear metre rate, or by number as scheduled in the Bills of Quantities.

The rates shall cover the cost of the collection of the pipes from pipe yard and for radiographic and/or hydraulic testing of bends, fittings specials, and installing flanges, couplings, valves and other appurtenances as scheduled, making good the coatings and linings, handling, inspecting, marking bends, fittings and specials with item numbers, transporting, holiday detection testing for coatings of steel pipes, forming joint ("fox") holes in all materials, bedding, laying, welding, jointing, cutting, all testing and disinfecting and where relevant all welding, radiographic and other testing as specified, and the completion of the internal and external corrosion protection (make good) and jointing materials (e.g. nuts, bolts, washers, gaskets, welding rods etc)."

The rates for the supply and installing of valves and specials shall cover the cost of any cutting, trimming, and jointing of pipes required for the installation of valves, bend, fittings in the positions shown on the drawings. Unless specific provision is made in the Bills of Quantities, no separate payment will be made for forming of any additional joints and/or for the supply of additional jointing materials which may be required for the connection of cut pipes.

A maximum payment of 80 % of the tendered rates will be made for a completed section of pipeline which has not yet been hydraulically pressure tested and disinfected. A further payment of 20% of the tendered rates will be made upon successful completion of the pressure testing and disinfection for the relevant section of pipeline.

The rates tendered for the laying and bedding of pipes, bends, fittings, and valves, shall be deemed to exclude the costs associated with the field pressure testing and disinfection of the pipeline. Separate items have been included in the Bills of Quantities for the cost associated with the conveyance of water required for testing, pressure testing, and disinfection of the pipeline."

PSL 8.2.15 Special Wrapping in Corrosive Soil

Delete the heading and substitute: **"Corrosion Protection Unit:..."**

Add new Item:

"The costs of making good the internal linings and external coatings on all butt welded and fillet welded joints on the pipeline are to be included in the tendered rates for pipelaying."

PSL 8.2.16 Mitre Cut Joints (New Item)

Add new Item:

"Mitre cuts (two-piece bends) up to 10° in steel pipelines may be carried out in the field only if ordered by the Employer's Agent.

Mitre Cut Joints
.....
..... Unit: No

The rate shall cover the cost of cutting, forming, and bevelling the ends of the pipes at the joint, all welding, testing and forming joint holes in all materials and for completion of the internal and external corrosion protection at the joints."

PSL 8.2.17 Cutting Pipes (New Items)

Add new items:

"Extra over for forming scarf joint.....Unit: No

Extra over for forming mitre cut joint.....Unit: No

Extra over for cutting pipe as closure.....Unit: No

Payment will only be made where shown on the drawings or where instructed by the Employer's Agent Representative. No payment will however be made for cutting pipes to suit the installation of bends, fittings, and valves that are shown on the drawings.

The rates shall cover the cost of cutting, forming and bevelling the ends of the pipes at the joint, all welding, testing and forming joint holes in all materials and for completion of the internal and external corrosion protection at the joints."

PSL 8.2.19 Corrosion Protection of Valves & Flexible and Flanged Joints

Add new Item:

"External corrosion protection to valves, flexible & flanged joints complete as above
.....Unit: No

Separate items will be scheduled for each item by pipe nominal diameter.

In the case of valves, the rate shall include for protection of the whole of the valve body, all flanges integral to the valve, the connecting flanges to the valve i.e. including the two flanges of the pipework connected to either side of the valve, and the packing of mastic (without tape or sheathing) over the gland adjusting bolts and nuts."

PSL 8.2.20 Repair of FBMDPE Coatings Defects (New sub-Clause)
Add new sub-clauses:

PSL 8.2.20.1 Repair a defect smaller than 650mm^2

Repair defects in FBMDPE coatings according to PSL 3.9.3.1 & PSL 3.9.3.12 ..... Unit: No

C3.7.10PSLB : BEDDING (PIPES)

(Applicable to SABS 1200 LB - 1983)

PSLB 2.3 DEFINITIONS

Main fill:

Delete "150mm" in second line and substitute "300mm".

PSLB 3 MATERIALS

PSLB 3.1 Selected Granular Material

Delete the sub-Clause and substitute:

Selected granular material shall be a granular material with a PI not exceeding 6, grading modulus not less than 1,2, free from lumps or stones retained on a 10 mm sieve and having a compactibility factor (as determined by the test given in Section LB of Part 3 of SANS 0120) not exceeding 0,4.

Add to the sub-clause:

Where scheduled and/or shown on the drawings, bedding material (padding) as specified in PSLB 3.3 shall be used in place of selected granular material.

PSLB 3.2 Selected Fill Material

In the first line delete "PI not exceeding 6" and substitute "PI not exceeding 10".

In the second line delete "30mm" and substitute "20mm".

Add to the sub-clause:

Where scheduled and/or shown on the drawings, bedding material (padding) as specified in PSLB 3.3 shall be used in place of selected fill material.

PSLB 3.3 Bedding

The steel and HDPE pipes to be laid under this contract are to be considered as 'flexible' for the purpose of bedding.

Bedding (selected granular and selected fill material) for steel pipes shall be fine sand or fine noncohesive soil, carefully selected, with maximum particle size of 5 mm and which shall not cake nor form lumps when drying. Material complying with the above requirements will also be referred to in this document as "padding".

Samples of bedding sand (padding) shall be submitted by the Contractor to the Employer's Agent for approval well in advance of construction. Only after the Contractor has received written approval from the Employer's Agent, may he/she proceed with placing sand as selected granular material.

No sharp-edged stones shall be allowed to come into contact with the pipes or fittings. Joint holes (pockets) shall be provided in the trench bottom and bedding, at each pipe joint to facilitate welding, and no extra payment will be made for forming or filling the joint holes (pockets) with padding sand.

All "padding" material used for the cradle beneath and surrounding the pipes shall comply with the following requirements:

GRADING ANALYSIS RANGE	
SIEVE SIZE (mm)	**PERCENTAGE PASSING**
6,7	98 to 100
4,76	85 to 100
2,36	55 to 95
1,18	30 to 75

0,60	20 to 50
0,425	16 to 38
0,30	13 to 27
0,15	5 to 18
0,075	0 to 12

The material shall be free of organic matter and shall have a compatibility factor of not more than 0.4. The material should be classified as silty to fine sand having a stiffness ratio of not less than 5,0 MPa. Furthermore, the origin of the materials should, preferably, be river transported since it is preferable that the larger grains (3,0 to 4,8 mm in size) be rounded and not sharp and angular.

The Contractor will be required to carry out his/her own quality control testing of the material to ensure that it meets the padding sand requirements and complies with this specification at all times. At least one grading analysis shall be carried out for every 100 lineal metres of bedding placed. The results of these tests shall be forwarded to the Employer's Agent within 24 hours of completion of the test. Should the material not comply with the specification, the Contractor shall remove and replace it with approved material at his/her own cost.

Depending on the actual material supplied by the Contractor, the moisture content may be critical to enable satisfactory placing and compaction, and the Contractor will be deemed to have allowed in his tendered rate for any and all adjustments required to the moisture content of the padding material at all times.

Items have been provided in the Bill of Quantities for the provision of approved bedding sand from approved Commercial or other approved off-site sources for padding sand.

No extra payment will be made for forming or filling joint holes (pockets).

PSLB3.4Selection

PSLB 3.4.1 Suitable Material available from Trench Excavation

Delete the Sub-Clause and substitute the following:

The excavation of a pipe trench shall comply with the requirements of Sub-Clause 5.4 of SABS 1200 DB and the provisions of Sub-Clause 3.7 of SABS 1200 DB (in terms of which, for the purposes of providing bedding materials, the Contractor is not required to use selective methods of excavating) shall apply. Nevertheless, the Contractor shall take every reasonable precaution to avoid burying or contaminating

material that is suitable and is required for bedding or covering the pipeline. If, in the opinion of the Employer's Agent, bedding material can be produced from the excavated material, the Contractor shall, if so, ordered by the Employer's Agent, screen or otherwise treat (as scheduled) the excavated material in order to produce material suitable for bedding (see also Subclause PSLB 8.2.1).

PSLB 5 CONSTRUCTION

PSLB 5.1.2 Details of Bedding

Delete and replace with:

The pipelines are to be laid on the class of bedding indicated in the Bills of Quantities and/or on the drawings.

PSLB 5.1.2.1 Stone Drainage Layer Beneath Bedding (New Sub-Clause)

Add new Sub-Clause:

Where indicated on the drawings, or as otherwise indicated by the Employer's Agent, a 200 mm thick layer of 19 mm stone shall be placed beneath the bedding layer to act as a drainage channel for excessive groundwater. This layer shall be wrapped in approved geofabric and provided with outlet pipes if and where required or indicated by the Employer's Agent Representative.

PSLB 5.1.4 Compacting

Delete the second line and substitute:

top of the pipeline) shall be 93% mod AASHTO.

Add to Sub-Clause PSLB 5.1.4:

No heavy compaction equipment will be permitted for compaction of any pipe bedding, only pneumatic or hand rammers being acceptable. To this end, and to achieve the 100% compaction specified it is recommended that bedding be brought up evenly on either side of the pipe. The use of complete saturation of the material as a method of achieving the specified compaction may, subject to the

Employer's Agent's approval, be used. However, in this regard, contractors are advised that the presence of excessive quantities of water in the pipe trench could lead to flotation of the pipe.

Steps will have to be taken by the Contractor to ensure that flexible pipes do not deform excessively in cross-section during and after

construction and backfilling operations. The maximum deflection which will be acceptable at any stage during or after construction is 2% of the pipe diameter horizontally or vertically. The Contractor will be required to provide the necessary apparatus and to monitor deflection during construction.

Pipe deformations will only be maintained within the specified tolerances by correct backfilling practice. No heavy compaction equipment will be permitted for compaction of any pipe bedding, only pneumatic or hand rammers being acceptable. To this end, and to achieve the 93% compaction specified it is required that the bedding material be brought up evenly on either side of the pipe. The use of complete saturation of the material as a method of achieving the specified compaction may, subject to the Employer's Agent's approval, be used. However, in this regard, Tenderers are advised that the presence of excessive quantities of water in the pipe trench could lead to flotation of the pipe.

Prior to the commencement of pipelaying the Contractor will be required to submit, to the Employer's Agent, for his approval, a Method Statement detailing his proposed methods of placing, and compacting methods which he proposes to implement in order to ensure compliance with the specification.

PSLB 5.1.5 Testing (New Sub-Clause)

Flexible joints shall be left exposed with a minimum of 200mm clearance around the bottom of the pipe during hydraulic pressure testing of the pipe to facilitate inspection.

PSLB 5.2 Placing and Compacting of Rigid Pipes

PSLB 5.2.2 Class 'C' Bedding

Delete the third, fourth and portion of the fifth lines and substitute the following:

The pipes shall be bedded on a layer of compacted granular bedding material on which a 25mm thick layer of uncompacted granular bedding material has been placed and spread. Loose granular bedding material lying next to the pipe shall be placed into the haunch area and compacted with suitable hand tools, and additional selected granular material shall be added and compacted in layers until levels for the bedding cradle as shown on Dwg LB - 1 (c) are reached. The remainder of the bedding i.e. the selected fill blanket, shall be placed in layers up the sides of the pipe, each layer being compacted until levels are reached as shown on Dwg LB-1 (c).

PSLB 5.2.5 Stone Bedding (New Sub-Clause)

In areas where waterlogged conditions exist or where ordered by the Employer's Agent, special drains consisting of a 150mm thickness (See PSDB 5.5) of single sized stone with a geofabric filter surround ("Bidim" Grade A4 or similar approved) extending the full width of the trench shall be provided below the bedding to the pipes. The excavation for these drains will be measured in cubic metres at the contract rate applying to unsuitable excavation below the bottom of the trench. The stone filling will be paid for per cubic metre and the geofabric filter will be paid for per square metre. All measurements in this connection will be to a width equal to the base widths and depths ordered

PSLB 5.3 Placing and Compacting Flexible Pipes

PSLB 5.3(a)Bedding Cradle

Delete the sub-clause and substitute the following:

The pipes shall be bedded on a minimum 100 thick layer of compacted granular bedding material on which a 50 mm thick layer of uncompacted granular bedding material has been placed and spread. Loose granular bedding material lying next to the pipe shall be placed into the haunch area and compacted with suitable hand tools (covered with rubber to prevent damage to the pipe coating), and additional selected granular material shall be added and compacted in layers up to the mid-point of the pipe diameter in the vertical plane. The remainder of the bedding i.e. the selected fill blanket, shall be placed in layers up the sides of the pipe, each layer being compacted until a level of 300 mm above the crown of the pipe is reached.

All bell (fox) holes shall be filled with bedding material.

PSLB5.4 Concrete Casing to Pipes

Add to the Sub-Clause:

Where concrete casing is ordered by the Employer's Agent it is to be of grade 20/19 concrete with a minimum thickness of 150 mm above the top of the pipe.

PSLB 6 TOLERANCES

PSLB 6.1 Moisture Content and Density

Add to the Sub-Clause:

The permissible deviations applicable are to be those for Degree of Accuracy II class of work.

C3.7.11 PSM: ROADS (GENERAL)

(Applicable to SABS 1200 M - 1981)

PSM 7 TESTING

PSM 7.2 Process Control

Add to the subclause:

Any routine testing required of the Contractor in accordance with Clause 7.3 is to be undertaken by an approved independent testing laboratory approved by the Employer's Agent.

PSM 7.3 Routine Inspection and Testing Add new subclause:

PSM 7.3.4 Routine Inspection and Testing

Routine testing shall be carried out in accordance with TMH1 and at the frequency specified in the relevant standardised specification.

No claims will be allowed in the event of any delay caused by the Contractor failing to provide the results of testing timeously from whatever cause.

C3.7.12 PSMF: BASE

(Applicable to SABS 1200 MF - 1981)

PSMF 3 MATERIALS

PSMF 3.1 Gravel Classification for Excavation Purposes

PSMF 3.1.1 Method of Classifying

Delete the contents of the Subclause and replace with:

"Materials supplied from designated borrow pits shall not be classified."

PSMF 3.3 Physical and Chemical Properties

PSMF 3.3.1 Natural Gravel (Stabilised and Unstabilised)

Delete sub clause (a) and replace with:

(a) " The maximum particle dimension of the gravel shall not exceed 63 mm."

Delete sub clause (e) and replace with:

(e) The UCS after treatment shall be between 1,5 and 3,0 MPa after 7 days at 100% Mod AASHTO density, or between 1,0 and 2,0 MPa after 7 days at 97% Mod AASHTO."

PSMF 5 CONSTRUCTION

PSMF 5.3 Processing

Delete the Subclause and replace with

PSMF 5.3 Chemical Modification

The base material shall be prepared, broken down and spread. Road lime complying with the requirements of SANS 824 shall then be spread over the prepared base material at a rate of 3,0%. The materials shall then be mixed dry using road graders, ploughs and other suitable equipment until the lime is mixed thoroughly and uniformly with the base material. The mixed material shall then be watered, mixed and lightly compacted.

After 24 hours have elapsed the material shall be ripped, worked in the normal manner and compacted to 98% of modified AASHTO density."

PSMF 5.4 Placing and Compacation on a Base Other than a Waterbound Macadam Base

PSMF 5.4.1 Placing

Delete the Subclause and substitute:

"Before construction of the base is commenced, the Contractor shall ensure that:

(a) the underlying layer on which the base is to be constructed complies with the requirements of the Specification for that layer; and

(b) the kerbing and channelling shall have been completed and approved by the Employer's Agent.

All cast in-situ mountable kerbing, channelling, vehicle entrances, transitions, etc, shall have been laid for a period of at least 72 hours before construction of the base course is commenced.

Where a nominal thickness exceeding 150 mm has been specified, the base shall be constructed in approximately equal layers not exceeding 150 mm each".

PSMF 5.4.2 Gravel

Delete Subclause (a) and replace with:

(a) "In the case of natural gravels: 98% of Mod. AASHTO density. In the case of graded crushed stone and graded crushed stone with fines: 84%, 86% or 88% of apparent density as specified or itemised in the Bill of Quantities."."

PSMF 5.4.4 Compaction

PSMF 5.4.4.2 Delete the subclause 5.4.4.2 and replace with:

"In the case of natural gravels compaction shall be to 98% of Modified AASHTO maximum density and in the case of graded crushed stone and graded crushed stone with fines to 86% density, or such other density as may be indicated in the Bill of Quantities."

Add new subclause:

PSMF 5.4.4.3 Thicknesses (New Subclause)

The thicknesses of the layers after compaction shall be the thicknesses shown on the drawings."

PSMF 5.9 TRANSPORT

PSMF 5.9.1 Freehaul

Add to the subclause:

"All haul from the designated borrow pit shall be regarded as freehaul."

PSMF 8 MEASUREMENT AND PAYMENT

PSMF 8.3 SCHEDULED ITEMS

PSMF 8.3.3 Construct Base with Material from Commercial Sources or Designated Borrow Areas
Replace the description of the item with the following:

“PSMF 8.3.3 Construct Base Course with Material from Commercial Sources and Compact to 86% of Apparent Density"

PSMF 8.3.5 Process Base Material by the Following Processes, as Relevant, and Use in Base

Add the following sub-item:

"(e) Process base material by chemical modification

(applicable to item 8.3.1) ..... Unit: m^3

The tendered rate shall include full compensation for the chemical modification as specified, including all labour, transport, etc. The modifying agent shall be paid for under item PSMF 8.3.8."

PSMF 8.3.8 Stabilizing Agent

Replace the description of the item with the following:

“PSMF 8.3.8 Road lime for modification ..... Unit: t"

PSMF 8.3.9 Overhaul

Delete the subclause as no payment will be made for overhaul.

SPECIFICATION FOR WELDING OF PIPELINES & TESTING

The contractor shall refer to the below specification and shall allow for in he's rate, all procedures and equipment required for quality assurance (QA) for welding inline with the below specifications and maintenance and calibration of such equipment shall be at the Contractors cost

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Welding of Pipelines and Related Facilities

1 Scope

This standard covers the gas and arc welding of butt, branch, and fillet welds in carbon and low-alloy steel pipe and piping components used in the compression, pumping, and transmission of crude petroleum, petroleum products, fuel gases, carbon dioxide, nitrogen, and, where applicable, covers welding on distribution systems. It applies to both new construction and in-service welding. The welding may be done by a shielded metal arc welding, submerged arc welding, gas tungsten arc welding, gas metal arc welding, flux-cored arc welding, plasma arc welding, or oxyacetylene welding process, or by a combination of these processes using a manual, semiautomatic, or mechanized welding technique or a combination of these techniques. The welds may be produced by position or roll welding or by a combination of position and roll welding.

This standard also covers the procedures for radiographic, magnetic particle, liquid penetrant, and ultrasonic testing, as well as the acceptance standards to be applied to production welds tested to destruction or inspected by radiographic, magnetic particle, liquid penetrant, ultrasonic, and visual testing methods.

The values stated in either U.S. customary units (USC) or metric units (SI) are to be regarded separately as standard. Each system is to be used independently of the other, without combining values in any way.

The figures depicted in this standard are not drawn to scale.

It is intended that all work performed in accordance with this standard meets or exceeds the requirements of this standard.

While this standard is comprehensive, it may not address all issues that may arise. The absence of guidance or requirements is not to be considered prohibitive to a particular activity or approach that is based upon sound engineering judgment. For example, other industry standards, reliable engineering tests and analyses, or established industry practices may provide useful reference to establish sound engineering judgment.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Specification 5L, *Specification for Line Pipe*

ASNT[1] SNT-TC-1A, *Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing*

ASTM[2] E23, *Standard Test Methods for Notched Bar Impact Testing of Metallic Materials*

ASTM E165, *Standard Test Method for Liquid Penetrant Examination*

ASTM E384, *Standard Test Method for Knoop and Vickers Hardness of Materials*

ASTM E709, *Standard Guide for Magnetic Particle Testing*

ASTM E747, *Standard Practice for Design, Manufacture and Material Grouping Classification of Wire Image Quality Indicators (IQI) Used for Radiology*

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[1] American Society for Nondestructive Testing, 1711 Arlingate Lane, Columbus, Ohio 43228-0518, www.asnt.org.
[2] ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, www.astm.org.

ASTM E1025, *Standard Practice for Design, Manufacture, and Material Grouping Classification of Hole-Type Image Quality Indicators (IQI) Used for Radiography*

AWS A3.0[3], *Standard Welding Terms and Definitions*

AWS A5.1, *Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding*

AWS A5.2, *Specification for Carbon and Low-Alloy Steel Rods for Oxyfuel Gas Welding*

AWS A5.5, *Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding*

AWS A5.17, *Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding*

AWS A5.18, *Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding*

AWS A5.20, *Specification for Carbon Steel Electrodes for Flux Cored Arc Welding*

AWS A5.28, *Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding*

AWS A5.29, *Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding*

AWS A5.32, *Welding Consumables – Gases and Gas Mixtures for Fusion Welding and Allied Processes*

AWS A5.36, *Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding*

BS EN ISO 15653[4], *Metallic Materials. Method of Test for the Determination of Quasistatic Fracture Toughness of Welds*

ISO 19232-1[5], *Non-destructive testing—Image quality of radiographs—Part 1: Image quality indicators (wire type)—Determination of image quality value*

NACE MR0175/ISO[6] 15156 (all parts), *Petroleum and Natural Gas Industries—Materials for use in H_2S-containing Environments in Oil and Gas Production*

3 Terms, Definitions, Acronyms, and Abbreviations

3.1 Terms and Definitions

For the purposes of this standard, the welding terms and definitions given in AWS A3.0 and the following shall apply. When identical terms are defined in AWS A3.0 and this standard, the following definitions shall apply.

3.1.1
automated ultrasonic testing
AUT
A term that covers a wide range of ultrasonic testing systems and techniques utilizing automated mechanical scanners while recording ultrasonic results.

[3] American Welding Society, 550 NW LeJeune Road, Miami, Florida 33126, www.aws.org.
[4] British Standards Institution, Chiswick High Road, London W4 4AL, United Kingdom, www.bsi-global.com.
[5] International Organization for Standardization, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211 Geneva 20, Switzerland, www.iso.org.
[6] NACE International (formerly the National Association of Corrosion Engineers), 1440 South Creek Drive, Houston, Texas 77218-8340, www.nace.org.

3.1.2
back weld
A weld made at the back side of a groove weld as part of the original weld.

3.1.3
back weld repair
A repair weld made at the back side of a groove weld to repair a defect (or defects) in a completed weld.

NOTE A back weld repair is not a back weld

3.1.4
branch weld
A completed groove and/or fillet weld joining a set-on or set-in branch pipe or a set-on or set-in branch fitting to a run pipe.

3.1.5
burn-through
BT
A portion of the root bead where excessive penetration has caused the weld puddle to be blown into the pipe or fitting.

3.1.6
burn-through (in-service welds)
An event that occurs during in-service welding when the welding arc causes the pipe wall to be breached.

3.1.7
company
The owner company or the engineering agency in charge of construction.

NOTE A company may act through an inspector or another authorized representative.

3.1.8
contractor
An entity that includes the primary contractor and any subcontractors engaged in work covered by this standard.

3.1.9
cover pass repair
A repair to the weld face, primarily located within the external reinforcement, but that may extend into the base material and/or weld metal (e.g., including external undercut).

3.1.10
defect
An imperfection of sufficient magnitude to warrant rejection based on the acceptance criteria in this standard.

3.1.11
double repair
The second repair in a previously repaired area of a completed weld; typically referred to as a “repair of a repair” or a “re-repair.”

3.1.12
elongated linear indication
An indication with its greatest dimension in the weld length direction that exceeds three times its width.

3.1.13
full-thickness repair
A repair weld originating from the weld face that penetrates completely through the weld thickness after creating an open root without backing.

3.1.14
grinding
Mechanical means to remove material using abrasive methods.

3.1.15
half-circumference dual-welder qualification
Activity consisting of two welders welding on opposite sides of a full circumference pipe nipple.

NOTE This is regionally known as “brother-in-law” welding.

3.1.16
half-value layer
HVL
The thickness of an absorbing material required to reduce the intensity of a beam of incident radiation to one half of its original intensity.

3.1.17
heat input
The measure of energy transferred during welding.

NOTE See 5.3.2.6 for equations used to calculate heat input.

3.1.18
hollow bead (porosity)
HB
The elongated linear porosity that occurs in the root bead.

3.1.19
imperfection
A dscontinuity or irregularity that is detectable by methods outlined in this standard.

3.1.20
inadequate cross penetration
ICP
A subsurface lack of bond imperfection between the first inside pass and the first outside pass.

3.1.21
inadequate penetration due to high-low
IPD
The condition that exists when one edge of the root is exposed (or unbonded) because an adjacent pipe or fitting is misaligned.

3.1.22
inadequate penetration without high-low
IP
Incomplete filling of the weld root.

3.1.23
incomplete fusion
IF
A surface imperfection between the weld metal and the base material that is open to the surface.

3.1.24
incomplete fusion due to cold lap
IFD
An imperfection between two adjacent weld beads or between the weld metal and the base metal that is not open to the surface.

3.1.25
indication
The response or evidence from nondestructive testing.

3.1.26
instantaneous energy
Energy that is calculated at every instant in which current and voltage are sampled during arc welding prior to averaging instead of being calculated using average current and average voltage.

3.1.27
instantaneous power
Power that is calculated at every instant in which current and voltage are sampled during arc welding prior to averaging instead of being calculated using average current and average voltage.

3.1.28
internal concavity
IC
A root bead that is fused to and that completely penetrates the pipe wall thickness along both sides of the bevel, but whose center is below the inside surface of the pipe wall.

NOTE The magnitude of concavity is the perpendicular distance between an axial extension of the pipe wall surface and the lowest point on the weld bead surface.

3.1.29
interpass temperature
The temperature at a location near the start position of the welding arc(s) recorded immediately before initiating the next pass or passes (multi-arc processes).

3.1.30
linear indication
An indication with its greatest dimension in the weld length direction.

3.1.31
mechanized welding
The process where parameters and torch guidance are controlled mechanically or electronically, but may be manually varied during welding to maintain the specified welding conditions.

3.1.32
multiple repairs
More than one individual repair area location in a completed weld.

3.1.33
non-waveform-controlled process
A welding process in which arc voltage and/or arc current are maintained at a stable condition (for example, constant voltage spray gas metal arc welding or constant current gas tungsten arc welding).

3.1.34
partial-thickness repair
A repair weld that originates from the weld face or root bead surface extending into the weld but does not completely penetrate through the weld thickness.

3.1.35
porosity
Gas trapped by solidifying weld metal before the gas has a chance to rise to the surface of the molten puddle and escape.

3.1.36
position welding
Welding in which the pipe or assembly is not rotating while the weld is being deposited.

3.1.37
postheat
Heating a completed weld to temperatures intended to accelerate hydrogen diffusion.

NOTE Postheat is not PWHT (see 3.1.38).

3.1.38
postweld heat treatment
PWHT
Heating a completed weld to temperatures intended to result in stress relief, tempering, normalizing, or other metallurgical changes.

3.1.39
preheat temperature
The minimum temperature of the base material in the volume surrounding the point of welding immediately before welding is started. In a multipass weld, it is also the minimum temperature immediately before the second and subsequent passes are started.

3.1.40
qualified welder
A welder who has demonstrated the ability to produce welds that meet the requirements of Section 5, Section 6, Section 10, or Annex B of this standard.

3.1.41
qualified welding operator
A welding operator who has demonstrated the ability to produce welds that meet the requirements of Section 12 of this standard.

3.1.42
qualified welding procedure specification
A tested and proven detailed method by which sound welds with suitable mechanical properties can be produced.

3.1.43
radiographer
A person who performs radiographic operations.

3.1.44
repair
Any grinding or welding on a completed weld to correct an individual defect or accumulation of defects in the weld that has been rejected by visual or nondestructive testing in accordance with acceptance criteria in this standard.

3.1.45
repair area
One individual repair location in a completed weld that may include a single defect or accumulation of defects.

3.1.46
repair procedure
A tested and proven detailed method by which sound repairs with suitable mechanical properties can be produced.

3.1.47
repair weld
A weld made to repair a defect (or defects) found by visual testing and/or other nondestructive testing methods in a completed weld.

NOTE A welder may check their work visually throughout the welding process and after welding has been completed, and perform rework as necessary.

3.1.48
rework
During the welding or after the weld has been completed, the removal of an imperfection that requires grinding and/or welding that is performed prior to nondestructive testing.

NOTE Rework is not a repair. Once a weld is judged as either acceptable or unacceptable by visual testing and/or a nondestructive testing method, any modification performed to the weld is deemed a repair.

3.1.49
roll welding
Welding in which the pipe or assembly is rotated while the weld metal is being deposited at or near the top center.

3.1.50
root bead
The first or stringer bead that initially joins two sections of pipe, a section of pipe to a fitting, or two fittings.

3.1.51
rounded indication
An indication where the length is three times the width or less.

3.1.52
segment
A piece of base metal (pipe nipple or fitting) consisting of less than a full circumference section.

3.1.53
semiautomatic welding
Arc welding with equipment that controls only the filler metal feed. The advance of the welding arc is manually controlled.

3.1.54
slag inclusion
A nonmetallic solid entrapped in the weld metal or between the weld metal and the parent material. Slag inclusions may be elongated slag inclusions (ESIs) or isolated slag inclusions (ISIs).

3.1.55
stacked defects
Individual imperfections aligned in the radial (through-thickness) direction, at the same circumferential location, and that exceed the acceptance criteria of this standard.

3.1.56
test joint
Pipe nipples, segments of pipe nipples, fittings, segments of fittings, or any combination thereof joined for the purpose of qualifying welding procedures or welders and welding operators.

3.1.57
total image unsharpness
the blurring of test object features in a radiographical image resulting from any cause(s).

3.1.58
transverse indication
An indication with its greatest dimension across the weld.

3.1.59
undercutting
A groove melted into the parent material adjacent to the toe or root of the weld and left unfilled by weld metal. External undercutting (EU) is adjacent to the cover pass and internal undercutting (IU) is adjacent to the root bead.

3.1.60
UT qualification
A process carried out by the company of evaluating evidence, provided by the ultrasonic contractor, that the UT system can provide accurate detection and sizing in accordance with the requirements of 9.6 and/or Annex A.

3.1.61
UT system
Equipment utilized for ultrasonic testing.

3.1.62
visual examination or testing
Visual evaluation of the surface of a weld by qualified personnel (see 8.3) to evaluate the presence of surface discontinuities (see 6.4 and 9.7) and to determine the disposition of the weld (i.e., weld acceptability).

3.1.63
volumetric indication
An indication that is three-dimensional.

3.1.64
waveform-controlled process
A welding process in which cyclic arc voltage and/or arc current wave shapes are controlled (for example, pulsed spray gas metal arc welding or controlled short-circuit gas metal arc welding).

3.1.65
weld
A remelted and metallurgically altered area where two parts (for the purposes of this standard, typically two sections of pipe, a section of pipe to a fitting, or two fittings) are joined by melting a portion of each part by heating with an electric arc or flame source.

3.1.66
welder
A person who makes a weld.

3.1.67
weld face
An edxposed surface of a weld on the side from which welding was done.

3.2 Acronyms and Abbreviations

For the purposes of this standard, the following acronyms and abbreviations apply.

A welding current (amp)

AC alternating current

AUT automated ultrasonic testing

BT burn-through

C	carbon
CCD	charge coupled device
CE	carbon equivalent
CMOS	complimentary metal-oxide semiconductor
CO_2	carbon dioxide
Cr	chromium
CTOD	crack tip opening displacement
Cu	copper
CVN	Charpy V-Notch
D	pipe outer diameter (in. or mm)
DAC	distance amplitude correction
DC	direct current
DDA	digital detector array
DWE	double-wall exposure
DWV	double-wall viewing
D/t	pipe diameter-to-wall thickness ratio
ECA	engineering critical assessment
E_I	instantaneous energy measurement (kilojoules)
ESI	elongated slag inclusion
EU	external undercut
EW	electric resistance or electric induction weld
FAC	failure assessment curve
FAD	failure assessment diagram
FCAW-S	self-shielded flux-cored arc welding
FPD	flat panel detector
GMAW-S	short-circuiting gas metal arc welding
HAZ	heat-affected zone
HB	hollow bead porosity
HI	heat input

H_2S	hydrogen sulfide
HVL	half-value layer
IC	internal concavity
ICP	inadequate cross penetration
ID	inside diameter
IF	incomplete fusion
IFD	incomplete fusion due to cold lap
IP	inadequate penetration without high-low
IPD	inadequate penetration due to high-low
IQI	image quality indicator
ISI	isolated slag inclusion
IU	internal undercut
L	weld length (in. or mm)
LB	linear buried
LDA	linear diode array
LS	linear surface
Mn	manganese
Mo	molybdenum
MPS	manufacturing procedure specification
MUT	manual ultrasonic testing
NDT	nondestructive testing
Ni	nickel
OD	outside diameter
OFW	oxy-fuel welding
P_I	instantaneous power measurement (watts or joules per second)
PIP	phosphor imaging plate
PWHT	postweld heat treatment
RTR	real-time radiography
S	welding arc speed (in. per minute or mm per minute)

SAWH submerged-arc helical weld

SAWL submerged-arc longitudinal weld

SCC stress corrosion cracking

SMTS specified minimum tensile strength

SMYS specified minimum yield strength

SWE single-wall exposure

SWV single-wall viewing

t specified pipe wall thickness (in. or mm)

T transverse

TCG time-corrected gain

T_s arc time (seconds)

UT ultrasonic testing

V vanadium

V welding arc voltage (volt)

VC volumetric cluster

VI volumetric individual

VR volumetric root

WPS welding procedure specification

Y/T yield-to-tensile ratio

σ_t, ultimate tensile strength of the pipe material (ksi or MPa)

σ_y, specified minimum yield strength of the pipe material, or SMYS (ksi or MPa)

4 Specifications

4.1 Equipment

Welding equipment, both gas and arc, shall be of a size and type suitable for the work and shall be maintained in a condition that ensures acceptable welds, continuity of operation, and safety of personnel. Arc welding equipment shall be operated within the amperage and voltage ranges given in the qualified welding procedure specification. Gas welding equipment shall be operated with the flame characteristics and tip sizes given in the qualified welding procedure specification. Equipment that does not meet these requirements shall be repaired or replaced.

4.2 Materials

4.2.1 Pipe and Piping Components

This standard applies to the welding of pipe and piping components that conform to material and product specifications including, but not limited to:

a) API specifications,

b) ASME international specifications,

c) ASTM international specifications,

d) Manufacturers Standardization Society (MSS) specifications,

e) American National Standards Institute (ANSI) specifications.

This standard also applies to materials with chemical and mechanical properties that comply with one of the specifications listed in items a) through e) above, even though the material is not manufactured in accordance with the specification.

4.2.2 Filler Metals and Fluxes

4.2.2.1 Types

All filler metals and fluxes shall conform to one of the following, except as provided below:

a) AWS A5.1;

b) AWS A5.2;

c) AWS A5.5;

d) AWS A5.17;

e) AWS A5.18;

f) AWS A5.20;

g) AWS A5.23;

h) AWS A5.28;

i) AWS A5.29;

j) AWS A5.36.

Filler metals and fluxes that do not conform to the specifications listed may be used, provided they have been utilized during welding procedure qualification.

4.2.2.2 Storage and Handling

Filler metals and fluxes shall be stored and handled to avoid damage to them and to the containers in which they are shipped. Filler metals and fluxes in opened containers shall be protected from deterioration, and filler metals that are coated shall be protected from excessive changes in moisture. Filler metals and fluxes that show signs of damage or deterioration shall not be used.

4.2.3 Shielding Gases

4.2.3.1 Types

The purity and dryness of these atmospheres influence resulting weldments and should be of values suitable for the process and the materials to be welded. The shielding atmosphere to be used shall be qualified for the material and the welding process.

Atmospheres for shielding an arc are of several types and should consist of inert gases, active gases, or mixtures of inert and active gases.

4.2.3.2 Storage and Handling

Shielding gases shall be kept in the containers in which they are supplied, and the containers shall be stored in a manner compliant with the applicable safety regulations and manufacturer's recommendations. Gases shall not be field intermixed in their containers. Gases of questionable purity and those in containers that show signs of damage shall not be used.

5 Qualification of Welding Procedures with Filler Metal Additions

5.1 Procedure Qualification

This section shall apply to the qualification of welding procedures using manual welding and semiautomatic welding processes with filler metal additions.

When a welding procedure specification uses a combination of manual/semiautomatic and mechanized welding, the requirements of Section 5 and Section 12 shall apply to their portions of the welding procedure specification.

NOTE 1 Section 12 applies to the qualification of welding procedures using mechanized welding with filler metal additions.

Before production welding is started, a detailed welding procedure specification shall be established and qualified to demonstrate that sound welds with suitable mechanical properties (such as strength, ductility, and hardness) can be made by the procedure. The acceptance of the procedure qualification welds shall be determined by destructive testing in accordance with 5.6 or 5.8 as applicable.

NOTE 2 Multiple qualification welds may be combined to qualify a range of essential variables within one welding procedure specification.

5.2 Record

The details of each procedure qualification shall be recorded. The record shall document at a minimum the actual observed values for the variables to be specified per 5.3 and the complete results of the procedure qualification tests. The record shall be maintained as long as the procedure is in use.

NOTE An example of an acceptable form is shown in Figure 1.

5.3 Welding Procedure Specification

5.3.1 General

The welding procedure specification shall include the information specified in 5.3.2 where applicable.

NOTE An example of an acceptable form is shown in Figure 2.

5.3.2 Specification Information

5.3.2.1 Process

The specific process, method of application, or combination thereof shall be identified.

5.3.2.2 Materials

The SMYS range of the materials to which the procedure applies shall be specified.

5.3.2.3 Diameters and Wall Thicknesses

The ranges of specified outside diameters (ODs) and specified wall thicknesses over which the procedure is applicable shall be specified.

5.3.2.4 Joint Design and Weld Shape and Size

The specification shall include a sketch or sketches of the joint that show tolerances for the angle of bevel, the size of the root face, and the root opening or the space between abutting members. The tolerance ranges for cap height and width shall be specified for groove welds. The shape and size tolerance ranges of fillet welds shall be shown. If a backing is used, the type shall be specified.

5.3.2.5 Filler Metal, Flux, and Number of Beads

The sizes and classification of the filler metal and flux and the minimum number and sequence of beads shall be specified. When different numbers of beads and sequences of beads apply to different thickness ranges within the specified thickness range on the WPS, the number of beads and sequences shall be designated for company-defined subsets of the thickness range.

QUALIFICATION WELD REPORT

Date _____ Test No. _____ Test Type: ___Procedure ___Welder
Location _____
Welder(s) _____

Material Grade 1 _____
Material Grade 2 _____
Outside Diameter _____ Wall Thickness _____
Joint Type _____ Bevel Angle _____
Backing Type (if applicable) _____ Roll or Fixed Position _____

RECORDED WELDING PARAMETERS

Pass	Process and Direction of Welding	Filler Metal Classification and Diameter	Shielding Gas type and flow rate or Shielding Flux	Preheat / Interpass Temperature	Voltage	Amperage	Travel Speed	Heat Input
Root Bead								
Second Bead								

Note: Number of weld beads are not intended to be limited by this table and the table should be adjusted to present all required passes.

Time Between Passes: Root bead to 2nd bead: _____ , 2nd bead to 3rd bead: _____
Cooling Method (if applicable) _____
PWHT _____

MECHANICAL TEST RESULTS

TENSILE TESTS Report Number: _____

Specimen Number	Tensile 1	Tensile 2	Tensile 3	Tensile 4
Location				
Original specimen dimensions				
Original specimen area				
Maximum load				
Tensile strength				
Fracture location				

NICK BREAK TESTS Report Number:

Specimen Number	Nick 1	Nick 2	Nick 3	Nick 4	Nick 5	Nick 6	Nick 7	Nick 8
Location								
Result								

BEND TESTS Report Number:

Specimen Type and Number								
Location								
Result								

Remarks

Test made at _____ Date _____
Tested by _____ Supervised by _____

NOTE See 5.2; the use of this sample form does not exclude adding other details.

Figure 1—Sample Qualification Weld Report Form

WELDING PROCEDURE SPECIFICATION

WPS Number _____

Process(es)/Method of Application _____

Material grade(s) _____

Outside diameter _____ Wall thickness _____

Joint type _____ Bevel angle _____

Backing type (if applicable) _____ Roll or fixed position _____

Direction of welding _____ Number of welders _____

Preheat temperature _____ Interpass Temperature _____

Method of Heating _____

Filler metal(s) and Flux _____

Flame characteristics _____ Cleaning and/or grinding tools _____

Type and removal of lineup clamp _____ Minimum number of passes _____

Maximum time between root pass and start of the second pass _____ Maximum time between second pass and start of third pass _____

Method of cooling _____ PWHT procedure _____

JOINT DESIGN

SEQUENCE OF BEADS

WELDING PARAMETERS

Pass	Process / Electrical Characteristics	Filler Metal Group or Classification	Electrode Size	Shielding Gas Type and Flow Rate or Shielding Flux	Voltage Range	Amperage Range	Travel Speed Range	Heat Input Range
Root Bead								
Second Bead								

Note: Number of weld beads are not intended to be limited by this table and the table should be adjusted to present all required passes.

Supporting qualification weld report No(s). _____

Approved by: _____

NOTE See 5.3.1; the use of this sample form does not exclude adding other details.

Figure 2—Sample Welding Procedure Specification Form

5.3.2.6 Electrical Characteristics

The current and polarity shall be specified, and the range of voltage and amperage for each type and size of electrode, rod, or wire shall be shown.

NOTE Consult the filler metal manufacturer's recommended ranges for guidance. The specified ranges need not replicate either the recommended ranges or the observed ranges used in welding procedure qualification.

When required by Table 1, the heat input and the method of calculating heat input shall be specified.

Heat input for non-waveform-controlled processes shall be calculated per Equation (1):

$$HI = \frac{60VA}{1000S} \tag{1}$$

where

HI = heat input (kilojoules per in. or kilojoules per mm)

V = average welding arc voltage (volt)

A = average welding current (amp)

S = average travel speed (in. per minute or mm per minute)

Heat input for waveform-controlled processes shall be calculated per Equation (2) or Equation (3):

$$HI = \frac{E_I}{L} \tag{2}$$

where

HI = average heat input (kilojoules per in. or kilojoules per mm)

E_I = average instantaneous energy measurement (kilojoules)

L = weld length (in. or mm)

$$HI = \frac{P_I T_S}{1000L} \tag{3}$$

where

HI = average heat input (kilojoules per in. or kilojoules per mm)

P_I = average instantaneous power measurement (watt)

T_s = arc time (seconds)

L = weld length (in. or mm)

5.3.2.7 Flame Characteristics

For the oxy-fuel welding process, the specification shall indicate whether the flame is neutral, carburizing, or oxidizing. The size of the orifice in the torch tip for each size of rod or wire shall be specified.

5.3.2.8 Position

The specification shall indicate roll or fixed position welding.

5.3.2.9 Direction of Welding

The specification shall indicate whether the welding is to be performed in the vertical up, vertical down, or horizontal direction.

5.3.2.10 Time Between Passes

When using EXX10 or EXX11 electrodes, the maximum time between the completion of the root bead and the start of the second bead, as well as the maximum time between the completion of the second bead and the start of the third bead, shall be specified. The time shall be expressed as minutes or hours.

5.3.2.11 Type and Removal of Lineup Clamp

The specification shall indicate whether the lineup clamp is to be internal or external, or if no clamp is required. If a clamp is used, the minimum percentage of root bead completed before the clamp is released shall be specified.

5.3.2.12 Cleaning and/or Grinding

The specification shall indicate whether power tools or hand tools are to be used for cleaning, grinding, or both.

5.3.2.13 Preheat and Interpass Temperature

The method of heating and minimum preheat temperature immediately before welding is started shall be specified. The maximum interpass temperature shall be specified.

5.3.2.14 Shielding Gas and Flow Rate

The shielding gas classification and the range of flow rates shall be specified.

5.3.2.15 Shielding Flux

When applicable, the type of shielding flux shall be specified.

5.3.2.16 Speed of Travel

The range for speed of travel, in inches or millimeters per minute, shall be specified for each pass or grouping of passes.

Specified ranges for speed of travel need not replicate, but should be representative of the speed of travel used during procedure qualification.

5.3.2.17 Method of Cooling After Welding

If forced cooling is to be used, the specification shall designate the type of cooling after welding, such as forced cooling with water, as well as the maximum weld temperature prior to deliberate cooling.

5.3.2.18 Postheating for Hydrogen Diffusion

When used during qualification, the minimum temperature and time at temperature range of any postheating for hydrogen diffusion shall be specified.

5.3.2.19 Postweld Heat Treatment (PWHT)

The details of the PWHT procedure shall be specified in the WPS. PWHT procedures shall include method of application, heating rate, temperature range, time at temperature, and cooling rate.

5.4 Essential Variables

5.4.1 General

Welding procedure specifications shall be limited by the applicable essential variables provided in Table 1. Changes to essential variables shall necessitate requalification of the welding procedure specification or establishment and qualification of a new welding procedure specification.

5.4.2 Essential Variable Categories

The variables and qualification ranges specified in Table 1 are separated into two different categories. Category I essential variables shall apply when specified hardness and/or toughness values are not required by the company. Category II essential variables shall apply when hardness and/or toughness requirements are specified by the company.

Table 1—Essential Variables for Qualification of Welding Procedure Specifications

Welding Variable Subsection[a]	Change Requiring Requalification	Category I (Standard WPS)	Category II (Hardness and/or Toughness)
5.4.2.1 Welding Process	a) A change in welding process for any given pass or pass grouping (i.e., fill passes or cap passes).	X	X
	b) A change between manual application or semiautomatic application.	X	X
5.4.2.2 Base Material	a) A change in base material "nominal SMYS" greater than that of the base material used during qualification. When a procedure qualification test uses two different "nominal SMYS" materials, the procedure shall only be qualified to weld joints where at least one of the base materials is equal to or less than the lowest "nominal SMYS" base material used during qualification and the other no greater than the maximum of the combination. [b,c,d]	X	X
	b) Where t is the nominal pipe wall thickness used in procedure qualification, a change that falls outside the following ranges: i. t to $2t$ when t < 0.154 in. (3.9 mm) ii. 0.154 in. (3.9 mm) to $2t$ when 0.154 (3.9 mm) ≤ t ≤ 1.00 in. (25.4 mm) iii. $0.5t$ to unlimited when t > 1.00 in. (25.4 mm)	X	
	c) A change in nominal wall thickness plus or minus 25 % of the nominal thickness used during qualification.		X
5.4.2.3 Joint Design	a) A change from fillet weld to groove weld, but not vice versa.	X	X
	b) A major change in joint type. [e]	X	X
5.4.2.4 Backing Material	The deletion or change of backing material (steel, ceramic, non-ferrous, etc.). [f]	X	X
5.4.2.5 Position	A change in position from roll welding to fixed position, but not vice versa.	X	X
5.4.2.6 Filler Metal	a) A change in filler metal grouping(s) as specified in Table 2 when base material SMYS is less than the "nominal SMYS" of Grade X65. [b]	X	
	b) A change in sequence of deposition of filler metal groups when multiple filler metal groups are used for a single weld when base material SMYS is less than the "nominal SMYS" of Grade X65. [b]	X	
	c) A change in filler metal classification when base material SMYS is greater than or equal to the "nominal SMYS" of Grade X65. [b,g]	X	
	d) A change in sequence of deposition of filler metal classifications when multiple filler metal classifications are used for a single weld when base material is greater than or equal to the "nominal SMYS" of Grade X65. [b]	X	
	e) When the filler metal used during qualification is from group 1 through 3 in Table 2 and the base material SMYS is less than the "nominal SMYS" of Grade X65, any change in chemical composition designator or optional supplemental designator for toughness except for the following: i. the addition of the optional supplemental designator for toughness (-1); ii. a change in chemical composition designator within the group, A1, C1, C2, C3, C1L, C2L, C3L, M, P1, P2. [h]	X	
	f) When the filler metal during qualification has a G suffix designator only, a change in the manufacturer or trade name.	X	X
	g) When the filler metal used is not identified in Table 2, a change in AWS specification, AWS classification, or, for filler metals not having an assigned AWS specification or classification, a change in the nominal composition.	X	X
	h) A change in filler metal classification. [g]		X
	i) A change in sequence of deposition of filler metal classifications when multiple filler metal classifications are used for a single weld.		X

Table 1—Essential Variables for Qualification of Welding Procedure Specifications (continued)

Welding Variable Subsection[a]	Change Requiring Requalification	Category I (Standard WPS)	Category II (Hardness and/or Toughness)
5.4.2.7 Shielding Gas	a) A change in shielding gas classification in accordance with AWS A5.32.	X	X
	b) A change in shielding gas flow rate greater than 20 % below the nominal flow rate recorded during procedure qualification.	X	X
	c) The deletion of or change in nominal composition of backing gas when backing gas is used during qualification.	X	X
5.4.2.8 Electrical Characteristics [i]	a) A change in current/polarity type (DCSP/DCEN, DCRP/DCEP, AC).	X	X
	b) A change to or from a waveform-controlled process.	X	X
	c) A change in heat input exceeding ± 20 % of that recorded during qualification. [j]		X
5.4.2.9 Preheat Temperature	a) Any decrease in minimum base material preheat temperature below the base material preheat temperature recorded during qualification. [k]	X	X
	b) When preheat is not applied to the qualification test weld, the minimum temperature specified on the procedure shall be no less than the lesser of 60 °F (16 °C) or the actual base material temperature recorded prior to qualification welding.	X	X
5.4.2.10 Interpass Temperature	a) An increase in base material interpass temperature to greater than 500 °F (260 °C). [k,l,m]	X	X
	b) An increase in base material interpass temperature greater than 100 °F (55 °C) above the maximum base material interpass temperature recorded during procedure qualification. [k,l,m]		X
5.4.2.11 Pass Sequence	When using a temper bead technique, a change in bead deposition sequence.	X	X
5.4.2.12 Cooling	a) The addition or deletion of deliberate cooling methods.	X	X
	b) A change in the method of deliberate cooling after welding, resulting in a higher rate of cooling.	X	X
	c) An increase in the maximum weld temperature prior to deliberate cooling.	X	X
5.4.2.13 Postheating	a) The elimination of postheating for the purpose of promoting hydrogen diffusion.	X	X
	b) A reduction in postheating temperature greater than 60 °F (33 °C) from that used during qualification.	X	X
	c) Any reduction in postheating time at temperature from that used during qualification.	X	X
5.4.2.14 Postweld Heat Treatment	a) The addition or deletion of PWHT.	X	X
	b) When applied, a change in PWHT procedure.	X	X

[a] The subsection numbers in this column are provided for referencing purposes.

[b] "Nominal SMYS" is in reference to the material grade and intended to negate the slight differences in actual SMYS between material type of the same grade. For example, an API 5L X60 pipe and an ASTM A860 WPHY 60 fitting shall both be considered to have a "nominal SMYS" of 60 ksi.

[c] In addition to SMYS, base material manufacturing process, heat treating process, carbon equivalent, and chemical composition should be considered for impact to mechanical properties and weld crack susceptibility.

[d] When base material used during qualification has multiple grade markings, prior to qualification the company should designate the material as one single grade.

[e] Major joint types are square, closed square, single-bevel, single-J, double-bevel, double-J, single-V, single-U, double-V, double-U. A change to or from a compound bevel within a major joint type is not considered a major change in joint type.

[f] This requirement applies to the root pass only. Weld metal is not considered weld backing.

[g] The chemical composition designator is part of the AWS classification.

[h] For example, a change in suffix designator from A1 to B3, or vice versa, constitutes an essential variable. A change from A1 to C3, or vice versa, does not constitute an essential variable.

[i] Unless otherwise specified by company requirements, the above noted parameters should be recorded as averages representative of a weld pass or specific segment of a weld pass. Sampling of parameters for waveform-controlled processes should be at a sampling frequency no less than 10 kHz. The method used for recording and calculating heat input during production monitoring should be the same as that used during procedure qualification.

[j] As defined and calculated in 5.3.2.6.

[k] Procedures may be qualified with different interpass temperatures throughout the weld sequence.

[l] When procedures are qualified with different interpass temperatures throughout the weld sequence, the interpass temperatures shall be specified accordingly.

[m] Interpass temperatures shall be measured immediately prior to the start of subsequent weld passes.

Table 2—Filler Metal Groups

Group	AWS Specification	AWS Classification
1	A5.1	E6010, E6011
	A5.5	E7010-A1, E7010-P1, E7011-A1
2	A5.5	E8010-P1
3	A5.1	E6018, E7015, E7016, E7018, E7018M, E7016-1, E7018-1
	A5.5	E7015-C1L, E7016-C1L, E7018-C1L, E7015-C2L, E7016-C2L, E7018-C2L, E7018-C3L, E8016-C1, E8018-C1, E8016-C2, E8018-C2, E8016-C3, E8018-C3, E8018-P2, E8045-P2
5 [a]	A5.18	ER70S-2, ER70S-3, ER70S-6
	A5.28	ER70S-A1, ER80S-D2, ER80S-Ni1, ER80S-Ni2, ER80S-Ni3
6	A5.2	RG60, RG65
7	A5.20	E71T-1C, E71T-1M, E71T-9C, E71T-9M, E71T-12C, E71T-12M, E71T-12M-J
	A5.36	E71T-1C, E71T-1M, E71T-9C, E71T-9M, E71T-12C, E71T-12M, E71T-12M-J
8	A5.29	E81T-1Ni1C, E81T-1Ni1M, E81T1-1Ni2C, E81T-1Ni2M, E81T-1K2C, E81T-1K2M

[a] A shielding gas (see 5.4.2.7) is required for use with the electrodes in Group 5.

5.5 Welding of Test Joints—Butt Welds

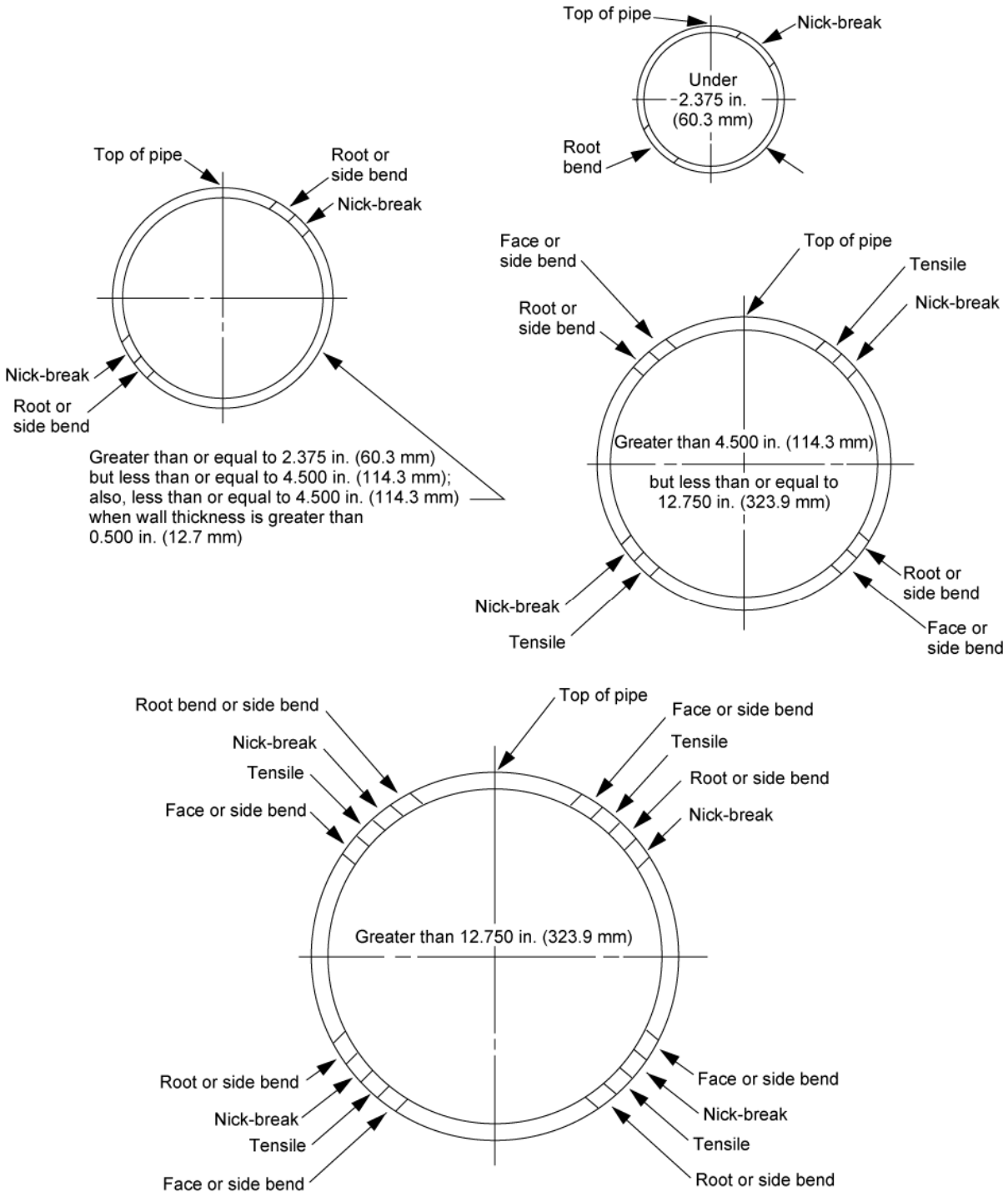
To weld the test joint for butt welds, two pipe nipples shall be joined.

5.6 Testing of Welded Joints—Butt Welds

5.6.1 Preparation

To test the butt-welded joint, test specimens shall be cut from the locations shown in Figure 3. The minimum number of test specimens and the tests to which they shall be subjected are given in Table 3. For pipe less than 2.375 in. (60.3 mm) in OD, two test joints shall be made to obtain the required number of test specimens. For pipe less than or equal to 1.315 in. (33.4 mm) in diameter, one full-section tensile strength specimen shall be tested. The full-section specimen shall be tested in accordance with 5.6.2.2 and shall meet the requirements of 5.6.2.3. All specimens shall be air cooled to ambient temperature prior to being tested.

When required by the company, the company shall specify the details of specimen preparation, testing, and acceptance criteria for measurement of hardness or toughness.



NOTE At the company's option, the locations may be rotated, provided they are equally spaced around the pipe; however, specimens do not include the longitudinal weld.

Figure 3—Location of Test Butt Weld Specimens for Procedure Qualification Test

Table 3—Type and Number of Test Specimens for Procedure Qualification Test

Outside Diameter of Pipe		Number of Specimens					
in.	mm	Tensile Strength	Nick Break	Root Bend	Face Bend	Side Bend	Total
Wall Thickness ≤ 0.500 in. (12.7 mm)							
< 2.375	< 60.3	0 [a]	2 [b]	2	0	0	4 [c]
2.375 to 4.500	60.3 to 114.3	0 [a]	2 [b]	2	0	0	4
> 4.500 to 12.750	>114.3 to 323.9	2	2 [b]	2	2	0	8
>12.750	> 323.9	4	4 [b]	4	4	0	16
Wall Thickness > 0.500 in. (12.7 mm)							
≤ 4.500	≤ 114.3	0 [b]	2 [b]	0	0	2	4
> 4.500 to 12.750	> 114.3 to 323.9	2	2 [b]	0	0	4	8
> 12.750	> 323.9	4	4 [b]	0	0	8	16

[a] For materials with nominal SMYS greater than Grade X42, a minimum of one tensile test is required.

[b] Nick break tests are not required for procedure qualification butt welds, provided procedure welds are examined by radiography or ultrasonic testing (UT) and are found acceptable per Section 9. When radiography or UT results are unacceptable, the procedure is rejected.

[c] One nick break and one root bend specimen are taken from each of two test welds, or for pipe less than or equal to 1.315 in. (33.4 mm) in diameter, one full-section tensile strength specimen is take.

5.6.2 Tensile Strength Test

5.6.2.1 Preparation

The full-thickness tensile strength test specimens shall be either of the types shown in Figure 4.

a) The sides of the full section specimen shown in Figure 4 a) shall be smooth and parallel.

NOTE 1 A specimen may be cut using any method, and no other preparation is needed unless the sides are notched or are not parallel.

b) The reduced section specimens shall be prepared as shown in Figure 4 b).

NOTE 2 The weld metal reinforcement may be removed.

5.6.2.2 Method

The tensile strength test specimens shall be broken under tensile load using equipment capable of measuring the load at which failure occurs. The tensile strength shall be computed by dividing the maximum load at failure by the smallest cross-sectional area of the specimen, as measured before the load is applied.

5.6.2.3 Requirements

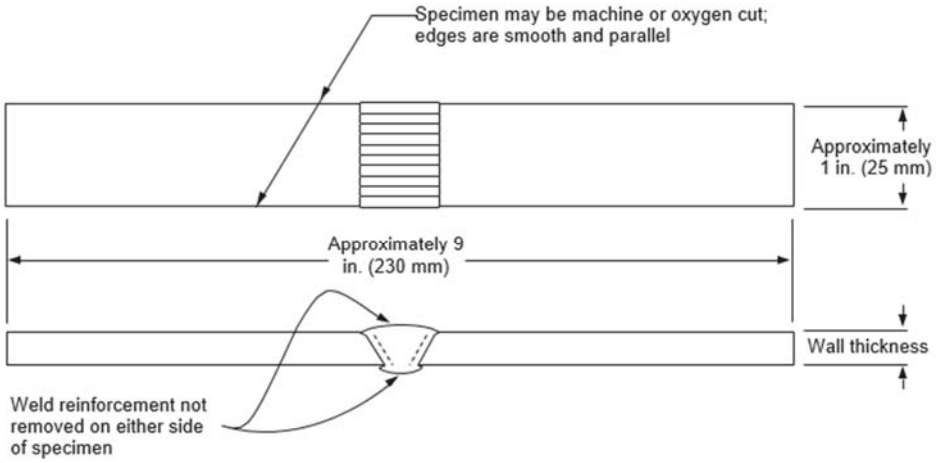
The tensile strength of the weld shall be greater than or equal to the specified minimum tensile strength (SMTS) of the pipe material, but need not be greater than or equal to the actual tensile strength of the material. If the specimen breaks outside the weld (i.e., in the parent metal) at a tensile strength not less than 95 % of that of the SMTS of the pipe material, the weld shall be accepted as meeting the requirements.

If the specimen breaks in the weld and the observed strength is greater than or equal to the SMTS of the pipe material and meets the soundness requirements of 5.6.3.3, the weld shall be accepted as meeting the requirements.

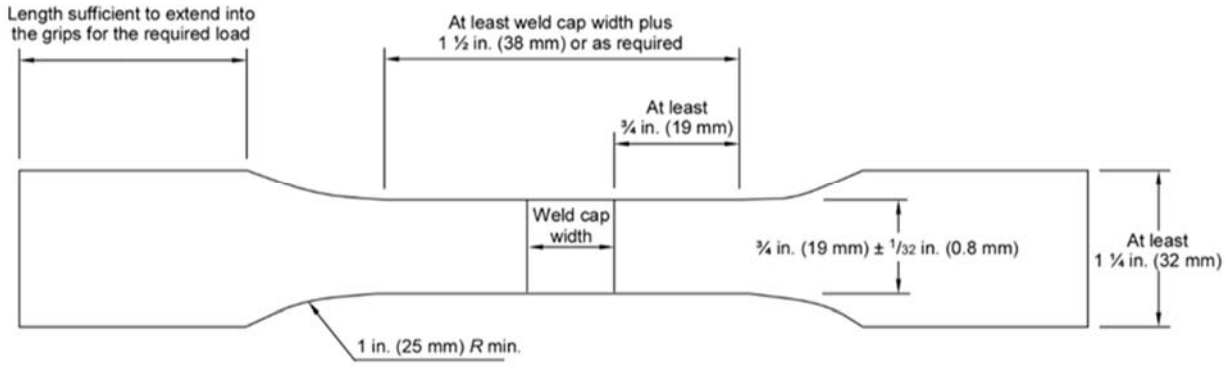
If the specimen breaks in the weld and below the SMTS of the pipe material, the weld shall be set aside, and a new test weld shall be made.

When welding material of different grades, the SMTS of the lower grade shall be used as the acceptance criteria.

NOTE Any specimen that fails due to improper specimen preparation or testing may be replaced and retested.



a) Full Section Tensile Strength Test Specimen



b) Reduced Section Tensile Strength Test Specimen

Figure 4—Tension Test Specimen

5.6.3 Nick Break Test

5.6.3.1 Preparation

The nick break test specimens (see Figure 5, top) shall be approximately 9 in. (230 mm) long and approximately 1 in. (25 mm) wide, and may be cut by any means. They shall be notched on each side at the center of the weld metal, and each notch shall be approximately 1/8 in. (3 mm) deep, and the edges shall be smooth and parallel.

NOTE 1 Nick break specimens prepared in this manner from welds made with certain mechanized and semiautomatic processes may fail through the pipe instead of the weld. When previous testing experience indicates that failures through the pipe can be expected, the external reinforcement may be notched to a depth of not more than 1/16 in. (1.6 mm), measured from the original weld surface (see Figure 5, bottom).

NOTE 2 At the company's option, nick break specimens for qualification of a procedure using a semiautomatic or mechanized welding process may be macroetched prior to being nicked.

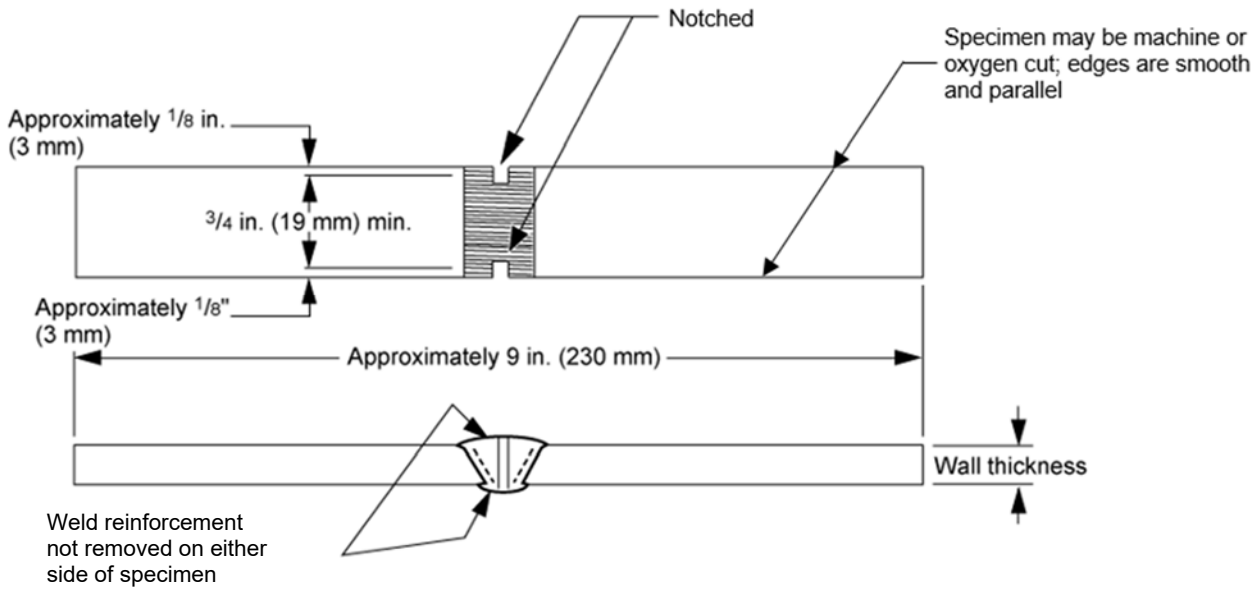
5.6.3.2 Method

The nick break specimens shall be broken through the weld by any convenient method (i.e., pulling, bending, or striking). This does not exclude other testing methods. The exposed area of the fracture shall be at least ¾ in. (19 mm) wide.

5.6.3.3 Requirements

The exposed surfaces of each nick break specimen shall show complete penetration and fusion. The greatest dimension of any gas pocket shall not exceed $^{1}/_{16}$ in. (1.6 mm), and the combined area of all gas pockets shall not exceed 2 % of the exposed surface area. Slag inclusions shall not be more than $^{1}/_{32}$ in. (0.8 mm) in depth and shall not be more than $^{1}/_{8}$ in. (3 mm) or one-half the specified wall thickness in length, whichever is smaller. There shall be at least ½ in. (13 mm) separation between adjacent slag inclusions of any size. The dimensions should be measured as shown in Figure 6. Fisheyes, as defined in AWS A3.0, are not cause for rejection.

For a test weld diameter greater than 12 ¾ in. (323.9 mm), if only one nick break specimen fails, the company shall have the discretion to either consider the weld unacceptable or to replace the specimen with two additional nick break specimens from locations as close as possible to the failed specimen. If either of the replacement nick break specimens fail, the weld shall be considered unacceptable.



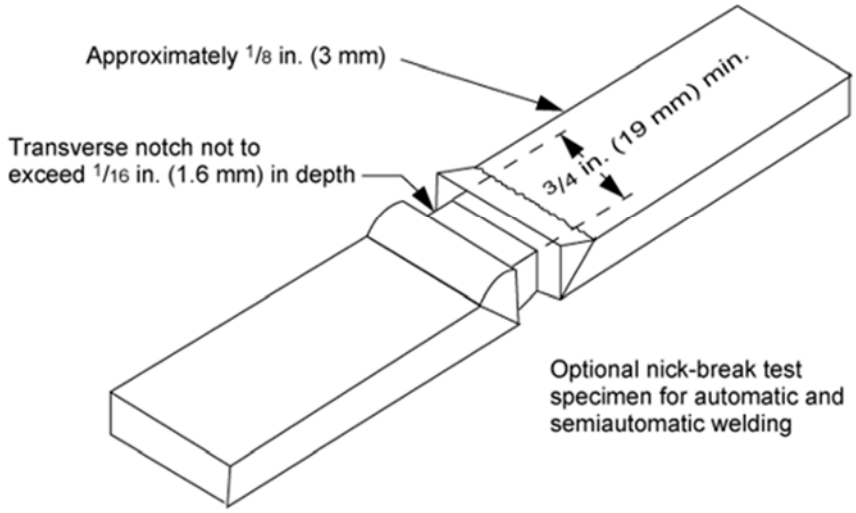
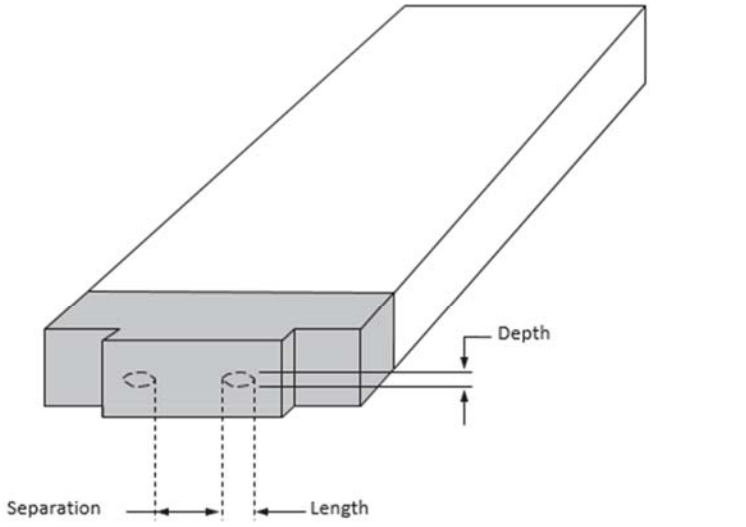


Figure 5—Nick Break Test Specimen



NOTE A broken nick break test specimen is shown; however, this method of dimensioning applies also to broken tensile and fillet weld test specimens.

Figure 6—Dimensioning of Imperfections in Exposed Weld Surfaces

5.6.4 Root and Face Bend Test

5.6.4.1 Preparation

The root and face bend test specimens (see Figure 7) shall be approximately 9 in. (230 mm) long and approximately 1 in. (25 mm) wide, and their long edges shall be rounded. They may be cut by any means. The cover and root bead reinforcements shall be removed flush with the surfaces of the specimen. These surfaces shall be smooth, and any scratches that exist shall be light and transverse to the weld. The specimen shall not be flattened prior to testing.

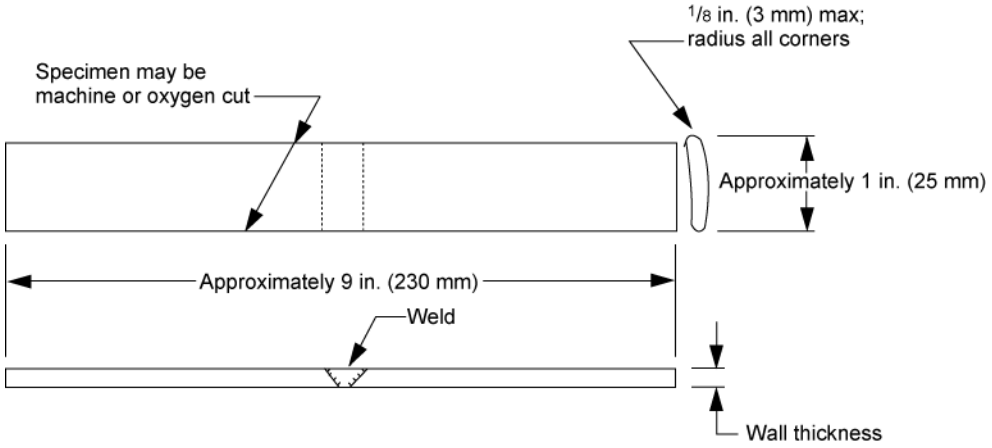
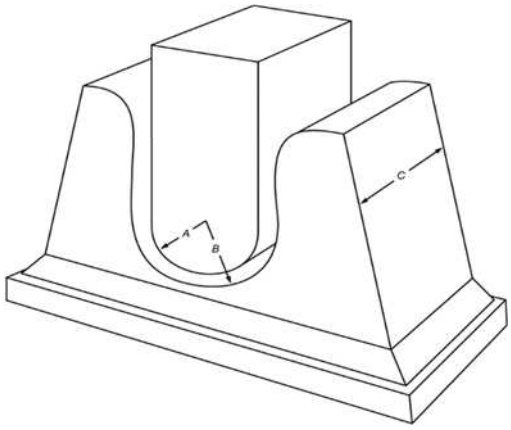


**Figure 7—Root and Face Bend Test Specimen:
Wall Thicknesses Less than or Equal to 0.500 in. (12.7 mm)**

5.6.4.2 Method

The root and face bend specimens shall be bent with the weld transverse to the longitudinal axis of the specimen. Face bend specimens shall be bent so that the face is centered on the bend radius and becomes the convex surface of the bend specimen. Root bend specimens shall be bent so that the root is centered on

the bend radius and becomes the convex surface of the bend specimen. The company shall specify the bend test fixture and bend radii. The radii shall not be greater than the radii specified in Figure 8.



NOTE This figure is not drawn to scale. Radius of plunger, A = 1 ¾ in. (45 mm); radius of die, B = 2 $^{5}/_{16}$ in. (60 mm); width of die, C = 2 in. (50 mm).

Figure 8—Jig for Guided-bend Tests

5.6.4.3 Requirements

The bend test shall be considered acceptable if no crack or other imperfection exceeding $^{1}/_{8}$ in. (3 mm) or one-half the specified wall thickness, whichever is smaller, in any direction is present in the weld or between the weld and the fusion zone after bending. Cracks that originate on the outer radius of the bend along the edges of the specimen during testing and that are less than ¼ in. (6 mm), measured in any direction, shall not be considered unless obvious imperfections are observed.

For a test weld diameter greater than 12 ¾ in. (323.9 mm), if only one bend specimen fails, the company shall have the discretion to consider the weld unacceptable or to replace the failed specimen with two additional specimens from locations adjacent to the failed specimen. If either of the replacement bend test specimens fails, the weld shall be considered unacceptable.

5.6.5 Side Bend Test

5.6.5.1 Preparation

The side bend test specimens (see Figure 9) shall be approximately 9 in. (230 mm) long and approximately ½ in. (13 mm) wide, and their long edges shall be rounded. They shall be machine cut, or they may be cut by other means to approximately a ¾-in. (19-mm) width and then machined or ground to the ½-in. (13-mm) width. The sides shall be smooth and parallel. The cover and root bead reinforcements shall be removed flush with the surfaces of the specimen.

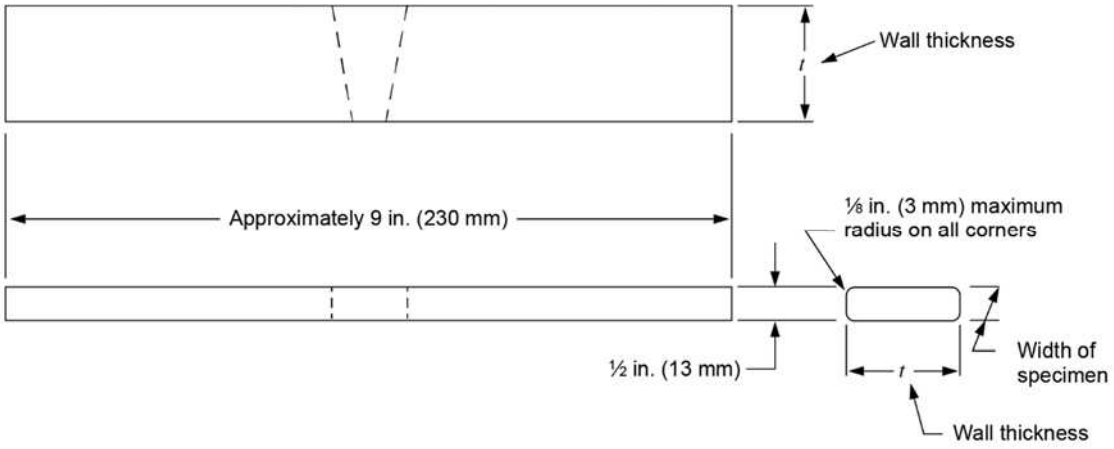
5.6.5.2 Method

The side bend specimens shall be bent with the weld transverse to the longitudinal axis of the specimen. Side bend specimens shall be bent so that one of the side surfaces is centered on the bend radius and becomes the convex surface of the bend specimen. The company shall specify the bend radii. The radii shall not be greater than the radii specified in Figure 8.

5.6.5.3 Requirements

Each side bend specimen shall meet the root and face bend test requirements specified in 5.6.4.3.

For a test weld diameter greater than 12 ¾ in. (323.9 mm), if only one side bend specimen fails, the company shall have the discretion to consider the weld unacceptable or to replace the failed specimen with two additional side bend specimens from locations adjacent to the failed specimen. If either of the replacement side bend test specimens fails, the weld shall be considered unacceptable.

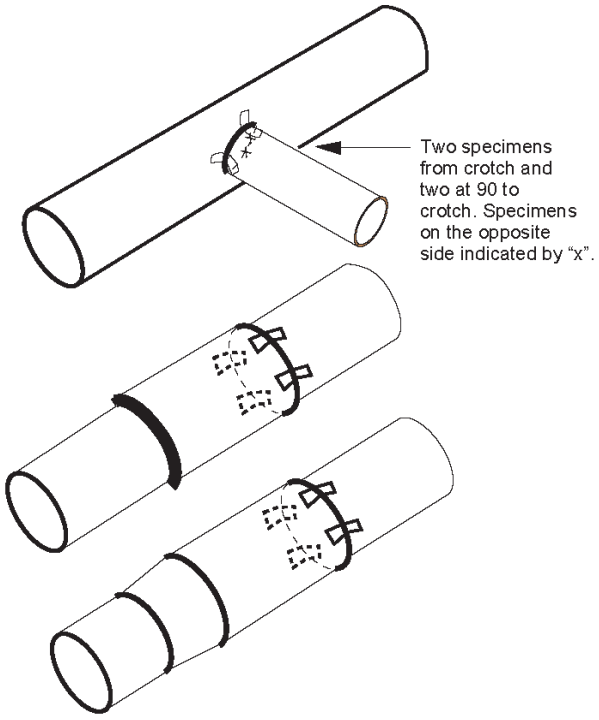


NOTE All dimensions are approximate.

Figure 9—Side Bend Test Specimen: Wall Thicknesses Greater than 0.500 in. (12.7 mm)

5.7 Welding of Test Joints—Branch and Fillet Welds

To weld the test joint for a branch or fillet weld, a weld shall be made to one of the configurations shown in Figure 10.



NOTE This figure shows the location of test specimens for joints with an OD greater than or equal to 2.375 in. (60.3 mm).

Figure 10—Location of Nick Break Test Specimens: Branch and Fillet Weld Procedure and Welder Qualification Test Welds

5.8 Testing of Welded Joints—Branch and Fillet Welds

5.8.1 Preparation

To test the branch or fillet-welded joint, test specimens shall be cut from the joint at the locations shown in Figure 10. At least four specimens shall be taken and prepared as shown in Figure 11.

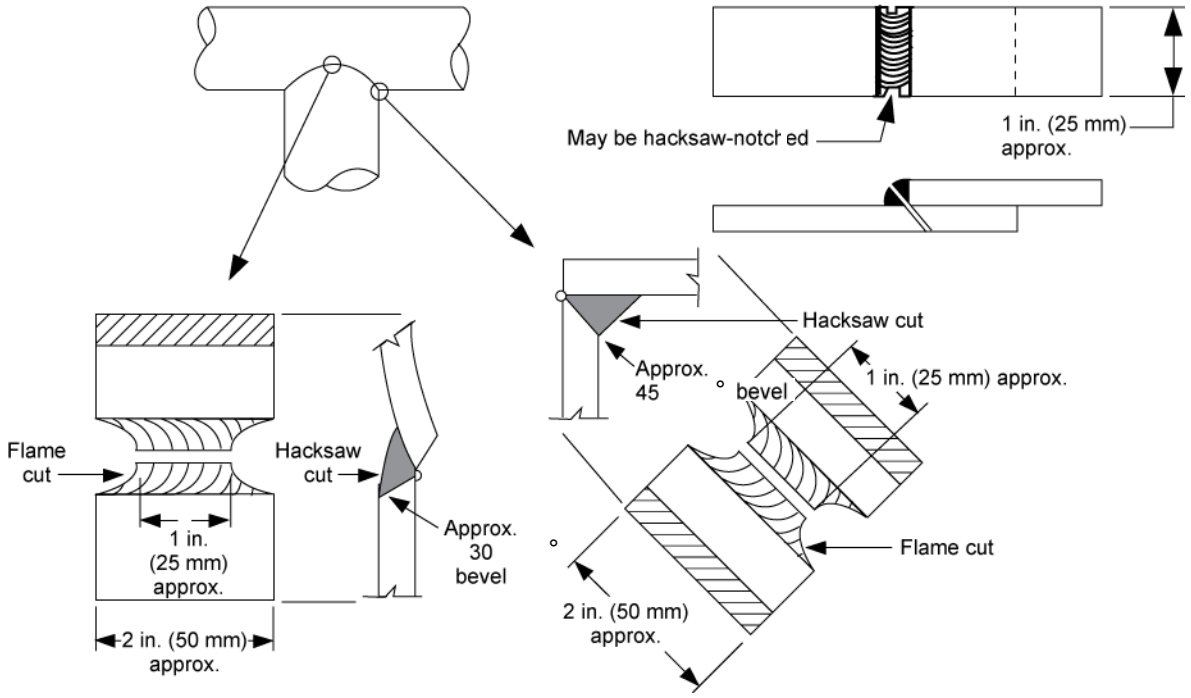
NOTE The specimens may be cut by any means.

The specimens should be at least 1 in. (25 mm) wide and long enough so that they can be broken in the weld. For pipes less than 2.375 in. (60.3 mm) in OD, specimens shall be cut from the same general location. It may be necessary to make two test welds to obtain the required number of test specimens; two specimens shall be removed from each of the two test welds. The specimens shall be air cooled to ambient temperature prior to testing.

When required by the company, the company shall specify the details of specimen preparation, testing, and acceptance criteria for measurement of hardness or toughness.

5.8.2 Method

The branch or fillet weld specimens shall be broken in the weld by any convenient method.



NOTE The methods of notching and cutting the specimens shown in the figure are not intended to preclude the use of other methods approved by the company.

Figure 11—Location of Nick Break Test Specimens: Branch and Fillet Weld Procedure and Welder Qualification Test Welds, Including Size-to-size Branch Connection Welder Qualification Test

5.8.3 Requirements

The exposed surfaces of each specimen shall show:

a) complete penetration and fusion;

b) the greatest dimension of any gas pocket shall not exceed $^1/_{16}$ in. (1.6 mm);

c) the combined area of all gas pockets shall not exceed 2 % of the exposed surface area;

d) slag inclusions shall not be more than $^1/_{32}$ in. (0.8 mm) in depth and shall not be more than $^1/_8$ in. (3 mm) or one half the specified wall thickness in length, whichever is smaller; and

e) there shall be at least $^1/_2$ in. (13 mm) separation between adjacent slag inclusions. The dimensions should be measured as shown in Figure 6.

6 Qualification of Welders

6.1 General

The purpose of the welder qualification test shall be to determine the ability of welders to make sound welds. Each welder shall be qualified according to the applicable requirements of 6.2 through 6.8 before making a production weld. It is possible to qualify a WPS and a welder with one test joint. It is the intent of this standard that a welder who satisfactorily completes the procedure qualification test shall be a qualified welder, provided the number of test specimens required by 6.5 has been removed, tested, and meet the acceptance criteria of 5.6, for each welder. In such cases, verified compliance to a WPS is not required as the welder will be establishing the WPS parameters as part of the qualification process. Replacement shall be allowed for the welding procedure qualification testing, even though the welder(s) was disqualified.

NOTE The essential variables associated with procedure and welder qualifications are not identical. The essential variables for welder qualification are specified in 6.2.2 and 6.3.2.

Prior to starting the qualification tests, the welder shall be allowed reasonable time to adjust the welding equipment to be used. The welder shall follow the requirements of the applicable qualified welding procedure specification unless the welder is welding a procedure qualification test joint. The qualification of welders shall be conducted in the presence of a representative acceptable to the company.

A welder shall qualify for welding by performing a test joint.

When segments of pipe nipples are used for a test joint, they shall be supported so that typical flat, vertical, and overhead welds are produced. Segments of pipe nipples or fittings shall not be used for test joints of diameters equal to or less than 12 ¾ in. (323.9 mm) OD.

When test joints are completed using full circumference pipe nipples or fittings with an OD greater than 12 ¾ in. (323.9 mm), a welder qualification test shall be performed by either:

1) welding the full circumference when it is permitted by the WPS used for qualification, or

2) a single welder welding at least one half of the circumference of a test joint, or

3) using two welders to complete the full circumference weld, during which each welder shall complete one half ($^1/_2$) the circumference from 12 o'clock to 6 o'clock position. In this "half-circumference dual-welder qualification" (see 3.1.15), the full circumference shall be welded using two welders, with each welder welding one half ($^1/_2$) the circumference that includes a top, side, and bottom portion of the test joint. Test specimens shall be removed from each welder's portion of the completed weld. Specimens shall not be removed from locations where weld beads deposited by one welder overlap weld beads deposited by the other welder.

For options 2) and 3), all the required test specimens required by 6.5 shall be removed from the half welded by each welder.

Welders shall fit-up the test joint in addition to making the test welds. Templates may be used to assist in the preparation of test joints.

The joint thickness shall be completed by one welder unless different processes, direction of travel, or filler metal groups (in accordance with Table 4) are used to complete the joint.

Table 4—Filler Metal Groups for Welder Qualification

Filler Metal Group	Welding Process	AWS Specification	AWS Classification[a]
WF-1[b]	SMAW	A5.1 or A5.5	EXX10-X(X), EXX11-X(X) electrodes
WF-2[c]	SMAW	A5.1 or A5.5	Any EXX15-XX(X), EXX16-XX(X), EXX18-XX(X), EXXX18-XX(X) electrodes
WF-3[d]	SMAW	A5.5	E8045-XX, E9045-XX, E10045-XX
WF-4[e]	GMAW or GTAW	A5.18	ERXXS-X
		A5.28	Any ERXX(X)S-XX(X) filler metals
WF-5	OFW	A5.2	RG60, RG65
WF-6[e]	FCAW	A5.20 or A5.36	Any EXXT-1C, EXXT-1M, EXXT-9C, EXXT-9M, EXXT-12C, or EXXT-12M
		A5.29	Any E(X)XX-1XX(X)M

[a] The system for identifying the electrode classifications in this standard follows the AWS filler metal specifications. The "X" is a designator in the AWS filler metal classification and can include any letter, number, or combination thereof, and when applicable, may be omitted (e.g., E6010 electrode is listed as WF-1).

[b] Cellulosic-coated electrodes

[c] Low hydrogen electrodes

[d] Low hydrogen vertical down electrodes

[e] A shielding gas (see 5.4.2.7) is required for use with the filler metals in Group WF-4 and WF-6.

When two welders are used to fill the joint thickness, each welder shall have a weld on one surface (i.e., one welder root surface, other welder cap surface). A defect(s) shall disqualify both welders regardless of the location of the defect(s).

For half-circumference dual-welder qualification, the failure of a test joint from one half of the weld circumference shall not impact the qualification of the other welder who welded the other half of the weld circumference.

A welder who qualifies as an in-service branch welder in accordance with Annex B shall be considered qualified to make non-in-service branch and fillet welds unless prohibited by the company. A welder who qualifies as an in-service fillet welder in accordance with Annex B shall be considered qualified to make non-in-service fillet welds unless prohibited by the company. A branch or fillet welder who is qualified in this manner shall be limited to the applicable range of essential variables described in 6.2.2 and not by the essential variables described in Annex B.

Welders shall not be considered to have a Section 6 multiple qualification by combining welds made in accordance with Section 6 and welds made in accordance with Annex B.

6.2 Single Qualification

6.2.1 General

For single qualification, a welder shall weld a test joint joining pipe nipples or segments of pipe nipples. For qualifications to make butt welds, the welder shall make a butt weld in either the rolled or the fixed position.

When the welder is qualifying in the fixed position, the axis of the pipe shall be horizontal, vertical, or inclined from horizontal at an angle of not more than 45°.

For the purpose of single qualification, the company shall decide if the welder is allowed to use pre-beveled fittings as branches. The company shall decide if welders are required to cut weld bevels for butt welds or for pipe nipples used as branches.

For single qualification tests, segments of pipe nipples representing a main line or “run pipe” (which the branch is welded to) may be used to qualify the welder to make branch attachments. The segments shall be approximately one half ($^1/_2$) the pipe circumference or greater.

Changes in the essential variables described in 6.2.2 shall require requalification of the welder. The welder shall not be restricted to welding only with the welding procedure followed during qualification testing, but is limited by the essential variables of the welder qualification.

The weld shall be acceptable if it meets the requirements of 6.4 and either 6.5 or 6.6.

6.2.2 Scope

A welder who has successfully completed the qualification test described in 6.2.1 shall be qualified within the limits of the essential variables described in 6.2.2. The welder shall be requalified if any of the following essential variables are changed:

a) A change from one welding process to another welding process or combination of processes, as follows:

   1) a change from one welding process to a different welding process; or

   2) a change in the combination of welding processes, unless the welder has qualified on separate qualification tests, using each of the welding processes that are to be used for the combination of welding processes.

b) A change in the direction of welding from vertical up to vertical down or vice versa, or a change from vertical progression to horizontal progression or vice versa. The specified direction of vertical progression is not intended to prevent welders from welding across the 12 o’clock or 6 o’clock of a horizontal pipe to avoid stacking starts and stops. A welder who has successfully completed the qualification test with the pipe fixed and axis inclined 45° from horizontal shall be qualified to also weld in horizontal position.

c) A change of filler metal, as follows:

   1) a change of filler metal grouping in Table 4; or

   2) a change of filler metal classification not listed in Table 4 to any other filler metal classification or vice versa.

d) A change from one specified OD group to another; however, for branch connection welds, the run pipe diameter is not an essential variable. These groups are defined as follows:

   1) specified OD less than 2.375 in. (60.3 mm);

   2) specified OD from 2.375 in. (60.3 mm) through 12.750 in. (323.9 mm);

   3) specified OD greater than 12.750 in. (323.9 mm).

e) A change from one specified wall thickness group to another; however, for branch connection welds and lap fillet welds, the run pipe thickness is not an essential variable. These groups are defined in Table 5.

f) A change from rolled to fixed position. A welder who qualifies in the fixed position shall also be qualified to perform rolled welds within the essential variables qualified.

g) A change in welding position. A welder who successfully passes a butt weld qualification test in the fixed position with the axis inclined 45° from horizontal shall be qualified to do butt welds and lap fillet welds in all positions.

NOTE Refer to AWS A3.0, Figure B.16C for position definitions.

h) A change in the joint design [see Note d) of Table 1]. A welder who qualifies on a butt weld shall also be qualified to make fillet welds within the essential variables qualified.

i) Elimination of a backing strip or weld metal.

j) Welders who qualify by welding a full penetration groove branch connection with fillet reinforcement with the axis of the header run pipe either horizontal or inclined from horizontal at an angle of not more than 45° shall be qualified to make the same production weld in the following positions:

1) all positions if the qualification test weld was made with the branch on the side of the pipe;

2) top and bottom if the qualification test weld was made with the branch on the bottom of the run pipe;

3) top, if the qualification test weld was made with the branch on the top of the run pipe.

NOTE The weld positions qualified by various branch orientations and branch-to-header size ratios are summarized in Table 6.

k) A change in the passes welded with a single process when more than one process is used to complete the joint. However, the welder may make production welds using only the process or processes used for fill and cap passes even if the test weld used a combination of processes. When the process used for fill passes in testing is used to make a complete production weld, the process shall have been used for three or more passes in the testing. Processes used for less than three passes in testing shall not be used for more than two passes in a production weld. For short circuiting transfer mode of gas metal arc welding (GMAW-S), the welder shall only use GMAW-S in production for the same passes that the welder used GMAW-S in qualification testing.

Table 5—Qualified Thickness Range for Single Qualification Test

Qualified Thickness Range	Thickness Tested (t)
t to the greater of 0.154 in. (3.9 mm) or 1.5t	when t < 0.154 in. (3.9 mm)
0.154 in. (3.9 mm) to the greater of 0.75 in. (19 mm) or 1.5t	when 0.154 in. (3.9 mm) ≤ t < 0.75 in. (19 mm)
0.75 in. (19 mm) to unlimited	when t ≥ 0.75 in. (19 mm)

Table 6—Qualification Scope for Single Qualification Test Using a Branch Connection [1]

Branch Test Position	Branch Diameter/Run Pipe Diameter Ratio in Test	Qualified Welding Position of Production Weld for Branch [a]	Qualified Pipe Angle for Full Circumference Lap Fillet Weld [b]
Top	< 0.75	Flat	75°–90° (horizontal weld)
	≥ 0.75	Flat, Vertical	0°–90°
Side	All	Flat, Vertical, Overhead	0°–90°
Bottom	< 0.75	Overhead, Flat	75°–90° (horizontal weld)
	≥ 0.75	Flat, Vertical, Overhead	0°–90°

NOTE This table does not negate or supersede the limitations of the diameter groupings for pipe girth welds or for branch diameters.

[a] Flat = 0° to approximately 15° (approximately 12 o'clock to 12:30 o'clock), Vertica l= Approximately 15° to approximately 105° (approximately 12:30 o'clock to 3:30 o'clock), Overhead = Approximately 105° to 180° (approximately 3:30 o'clock to 6 o'clock)

[b] 0° = horizontal, 90° = vertical pipe

6.3 Multiple Qualification

6.3.1 General

For multiple qualification, a welder shall successfully complete the two tests described below. Both test welds shall be welded using the same process or combination of processes and the same filler metal group or groups in Table 4.

NOTE 1 The two tests may be given in any order.

For one test, the welder shall make a butt weld in the fixed position with the axis of the pipe either horizontal or inclined from horizontal at an angle of not more than 45°. This butt weld shall be made on pipe with an OD of at least 6.625 in. (168.3 mm) and with a wall thickness of at least 0.250 in. (6.4 mm) without a backing strip. The weld shall be acceptable if it meets the requirements of 6.4 and either 6.5 or 6.6. Specimens shall be removed either from the test weld at the locations shown in Figure 12, at the relative locations shown in Figure 12 but without reference to the top of the pipe, or from locations that are spaced equidistantly around the entire pipe circumference. The sequence of adjacent specimen types shall be identical to that shown in Figure 12 for the various pipe diameters. Specimens shall not include the longitudinal weld.

When test joints are completed using full circumference pipe nipples or fittings with an OD greater than 12 ¾ in. (323.9 mm), a welder qualification test shall be performed by either of the following methods:

1) The full circumference shall be welded by a welder when it is allowed by the WPS used for qualification, or

2) A single welder welds at least one half ($^1/_2$) of the circumference of a test joint, or

3) By using two welders to complete the full circumference weld, during which each welder shall complete one half ($^1/_2$) the circumference from the 12 o'clock to 6 o'clock position. In this "half-circumference dual-welder qualification" (see 3.1.15), the full circumference shall be welded using two welders, with each welder welding one half ($^1/_2$) the circumference that includes a top, side, and bottom portion of the test joint. Test specimens shall be removed from each welder's portion of the completed weld. Specimens shall not be removed from locations where weld beads deposited by one welder overlap weld beads deposited by the other welder.

For options 2) and 3), all the required test specimens required by 6.5 shall be removed from the half welded by each welder. See Figure 13.

NOTE 2 When only one half (½) of a pipe circumference is welded during testing or when a pipe segment is welded during testing, precautions to minimize distortion of the test joint may be necessary to allow removal and testing of the required test specimens. Examples of precautions include use of tack welds or fixturing.

For the other test, the welder shall lay out, cut, fit, and weld a branch-on-pipe connection in which the specified diameters of the run and the branch pipes are equal. This test shall be performed with a pipe diameter of at least 2.375 in. (60.3 mm) and with a specified wall thickness of at least 0.250 in. (6.4 mm). When small-diameter pipe is used for testing, more than one test weld may be required to obtain the required number of test specimens.

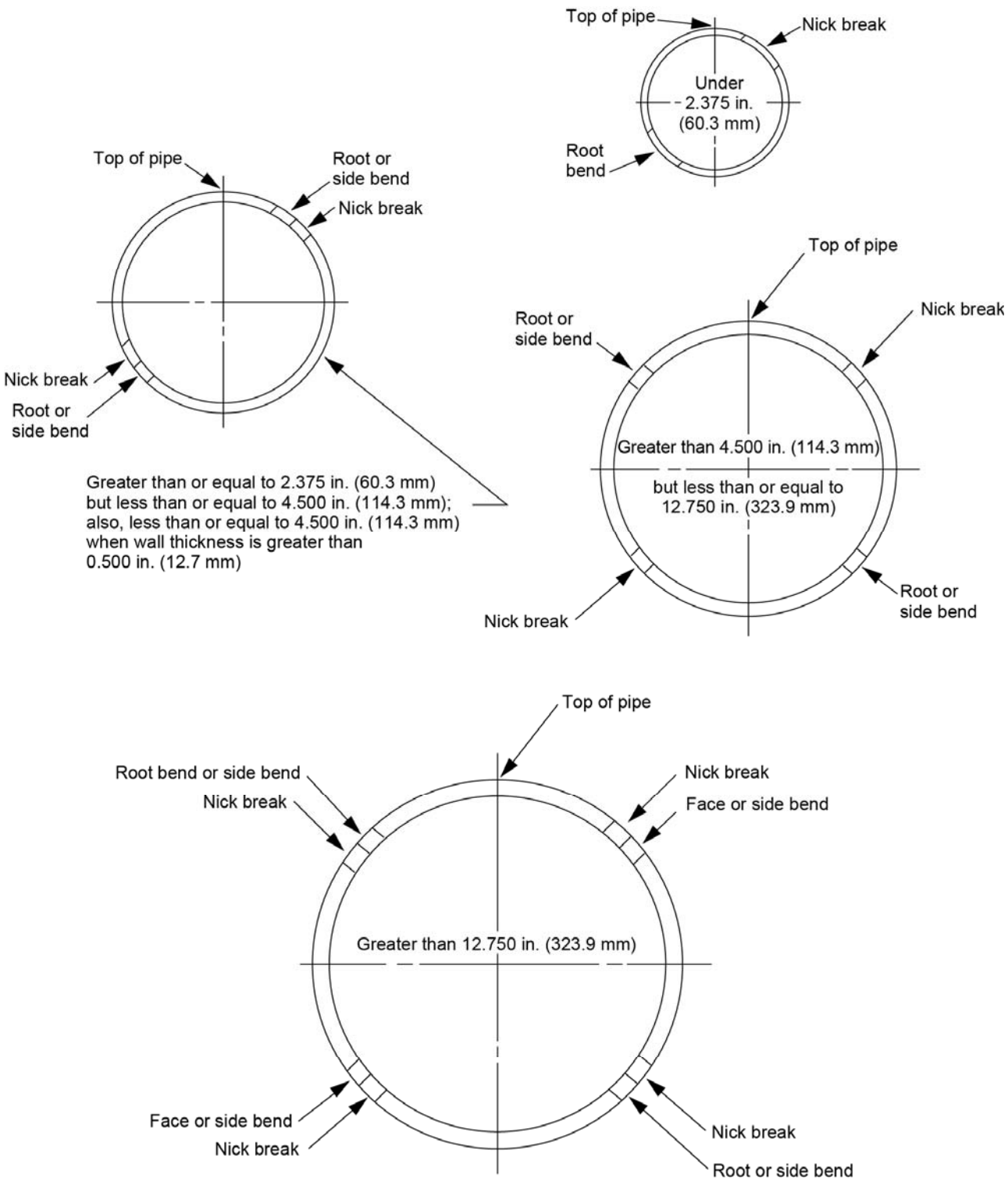
A hole with a specified diameter approximately equal to the inside diameter (ID) of the branch pipe shall be cut in the run. The company shall decide if the welder shall cut the hole in preparation of the branch assembly.

Use of templates to assist in layout shall be at the discretion of the company. Use of manually operated mechanisms that assist in accurate cutting of the hole or to prepare the branch bevel shall be at the discretion of the company.

The weld shall be made with the run pipe in the fixed horizontal position, with the branch pipe axis extending either vertically downward from the run pipe or projecting from the side of the run pipe.

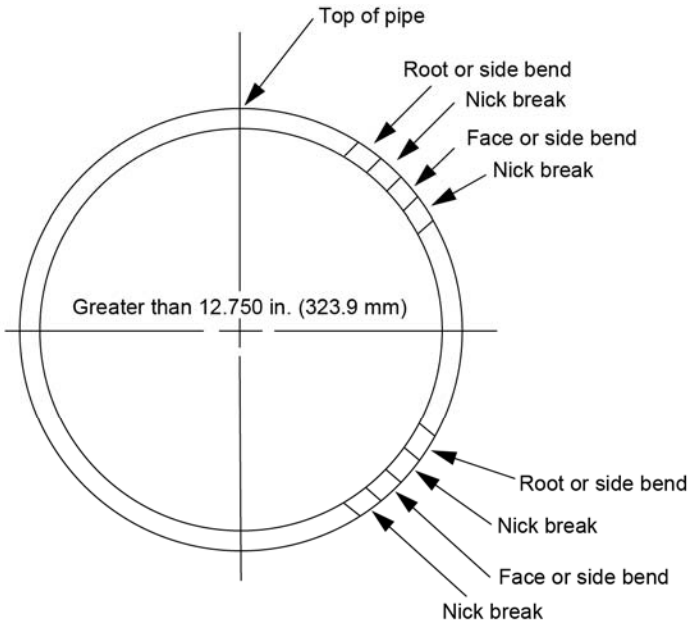
If the welder fails either the butt or the branch test weld, the welder shall be required to retest only for the failed weld. The welder shall not be required to repeat both the butt and the branch test weld unless required by the company.

The welds shall be acceptable if they meet the requirements of 6.4 and either 6.5 or 6.6.



NOTE At the company's option, the locations may be rotated, provided they are equally spaced around the pipe; however, specimens do not include the longitudinal weld.

Figure 12—Location of Test Butt Weld Specimens for Welder Qualification Test (Full Circumference)



NOTE 1 At the company's option, this setup may be used for qualifying welders using the half-circumference dual-welder technique or when the test weld consists of a segment or a weld on only one half (1/2) of a full circumference.

NOTE 2 The illustration shows samples for one welder who welded half of the circumference.

Figure 13—Location of Test Butt Weld Specimens for Welder Qualification Test (Half Circumference)

6.3.2 Scope

A welder who has successfully completed the butt weld qualification test described in 6.3.1 on pipe with an OD greater than or equal to 12.750 in. (323.9 mm) and a branch weld with pipe and branch having specified OD greater than or equal to 12.750 in. (323.9 mm) in which the specified diameters of the run and branch pipes are equal shall be qualified to weld in all positions; on all wall thicknesses, joint designs, and fittings; and on all pipe diameters using the same process or combination of processes and same filler metal groups (see Table 4) used for the two test welds. A welder who has successfully completed the butt weld and branch weld requirements of 6.3.1 on pipe with an OD less than 12.750 in. (323.9 mm) shall be qualified to weld in all positions; on all wall thicknesses, joint designs, and fittings; and on all pipe diameters less than or equal to the OD used by the welder in the qualification tests.

If any of the following essential variables are changed in a welding procedure specification, the welder using the new procedure shall be requalified:

a) A change from one welding process to another welding process or combination of processes, as follows:

   1) a change from one welding process to a different welding process; or

   2) a change in the combination of welding processes, unless the welder has qualified on separate qualification tests, each using the same welding process that is used for the combination of welding processes.

   3) a change in the passes welded with a single process when more than one process is used to complete the joint. However, the welder shall also be qualified to make production welds using only the process or processes used for fill and cap passes even if the test weld used a combination of processes. When the process used for fill passes in testing is used to make a complete production

weld, the process shall have been used for three or more passes in the testing. Processes used for less than three passes in testing shall not be used for more than two passes in a production weld.

b) A change in the direction of welding from vertical up to vertical down or vice versa.

c) A change of filler metal grouping in Table 4. A change of filler metal classification not listed in Table 4 to any other filler metal classification or vice versa.

6.4 Visual Examination

For a qualification test weld to meet the requirements for visual examination, the weld shall be free from cracks and inadequate penetration, and shall present a neat workmanlike appearance that is acceptable to the company.

For a butt weld, no burn-through (BT) shall be allowed. Branch connections shall not contain any BT having a length more than ¼ in. (6 mm). The sum of the maximum dimensions of separate unrepaired BTs in any continuous 12-in. (300-mm) length of branch connection weld shall not exceed ½ in. (13 mm).

External undercut (and internal undercut, when practical) shall be evaluated to the requirements of 9.7, and if any portion of the welder's qualification weld exceeds the undercut allowed by Table 8, the welder shall be disqualified.

All dimensional requirements specified in the WPS shall be met.

When semiautomatic or mechanized welding is used, filler wire protruding into the inside of the pipe shall be kept to a minimum. The company shall determine the acceptance criteria for the number of protruding wires.

Failure to meet the requirements of this section shall be adequate cause to eliminate additional testing.

6.5 Destructive Testing

6.5.1 Sampling of Test Butt Welds

To test butt welds, samples shall be cut from each test weld. Figure 12 shows the locations from which the specimens shall be removed if the test weld is a full circumference. Figure 13 shows the locations from which the specimens shall be removed if the test weld is completed as a half circumference. If the test weld consists of segments of pipe nipples, an approximately equal number of specimens shall be removed from each segment. The total number of specimens and the tests to which each shall be submitted are shown in Table 7. The specimens shall not include the longitudinal weld. The specimens shall be air cooled to ambient temperature prior to testing. For pipe with an OD less than or equal to 1.315 in. (33.4 mm), the company shall select qualification by testing either one full-section tensile specimen or testing root bend and nick break specimens. If a full-section tensile is used and the specimen breaks in the weld or at the junction of the weld and the parent material and fails to meet the soundness requirements of 5.6.3.3, the welder shall be disqualified.

Table 7—Type and Number of Butt Weld Test Specimens per Welder for Welder Qualification Test and Destructive Testing of Production Welds

Outside Diameter of Pipe		Number of Specimens				
in.	mm	Nick Break	Root Bend	Face Bend	Side Bend	Total
Wall Thickness ≤ 0.500 in. (12.7 mm)						
< 2.375	< 60.3	2	2	0	0	4 [a]
2.375 to 4.500	60.3 to 114.3	2	2	0	0	4
> 4.500 to 12.750	> 114.3 to 323.9	2	2	0	0	4
>12.750	>323.9	4	2	2	0	8
Wall Thickness > 0.500 in. (12.7 mm)						
≤4.500	≤114.3	2	0	0	2	4
> 4.500 to 12.750	>114.3 to 323.9	2	0	0	2	4
> 12.750	>323.9	4	0	0	4	8

[a] For pipe less than or equal to 1.315 in. (33.4 mm) in outside diameter, nick break and root bend specimens from two welds or one full-section tensile strength specimen is taken.

6.5.2 Nick Break Test Requirements for Butt Welds

For the nick break test, if any specimen shows imperfections that exceed those allowed by 5.6.3.3, the welder shall be disqualified. Replacement of a nick break specimen is not permitted for welder qualifications.

6.5.3 Bend Test Requirements for Butt Welds

For the bend tests, if any specimen shows imperfections that exceed those allowed by 5.6.4.3 or 5.6.5.3, the welder shall be disqualified. Welds shall not be rejected solely for failure of the specimen to bend to the full U shape. These welds shall be considered acceptable if the specimens that crack are broken apart and their exposed surfaces meet the requirements of 5.6.3.3.

If one of the bend test specimens fails to meet these requirements and, in the company's opinion, the imperfection observed is not representative of the weld, the test specimen shall be replaced by an additional specimen cut adjacent to the one that failed, or the welder shall be disqualified.

The welder shall be disqualified if the additional specimen also shows imperfections that exceed the specified limits.

6.5.4 Branch and Fillet Weld Test Requirements

Four nick break specimens shall be removed from the weld at the locations shown in Figure 10. They shall be prepared and tested in accordance with 5.8.1 and 5.8.2. The exposed surfaces shall meet the requirements of 5.8.3. If the test weld consists of segments of pipe nipples, an approximately equal number of specimens shall be removed from each segment. The specimens shall be air cooled to ambient temperature prior to testing.

6.6 Nondestructive Testing (NDT)—Butt Welds Only

6.6.1 General

If requested by the company, the qualification butt weld shall be examined by radiography or automated ultrasonic testing (AUT) using a qualified NDT procedure instead of or in addition to the tests specified in 6.5.

6.6.2 Inspection Requirements

When radiography is used, radiographs shall be made of each of the test welds. The welder shall be disqualified if any of the test welds do not meet the requirements of 9.3.

When AUT is utilized, each test weld shall be fully examined. The welder shall be disqualified if any of the test welds do not meet the requirements of 9.6.

Radiographic testing or AUT shall not be used for the purpose of locating sound areas or areas that contain imperfections and subsequently destructively testing such areas to qualify or disqualify a welder.

6.7 Retesting and Disposition of Test Results

If, in the mutual opinion of the company and the contractor's representatives, a welder fails to pass the qualification test because of unavoidable conditions or conditions beyond the welder's control, the welder should be given a second opportunity to qualify. No further retests shall be given until the welder has submitted proof of subsequent welder training that is acceptable to the company.

If the company elects to use both nondestructive tests and destructive tests to evaluate a welder test joint, failure to meet the acceptance criteria of either test shall result in failure of the test weld.

6.8 Records

A record shall be maintained of the tests given to each welder and of the detailed results of each test. In addition to the results of NDT or destructive test results, Figure 1—or a similar form developed to suit the needs of the individual company—should be used. Forms should be sufficiently detailed to demonstrate that the qualification test met the workmanship requirements of this standard and that the welder welded within the parameter ranges specified on the applicable WPS during the qualification test. A list of qualified welders and the procedures for which they are qualified shall be maintained.

If requested by the company, a welder shall requalify if a question arises about the welder's competence.

7 Design and Preparation of a Joint for Production Welding

7.1 General

Piping shall be welded by qualified welders using qualified procedures. The surfaces to be welded shall be smooth, uniform, and free from laminations, tears, scale, slag, grease, paint, and other deleterious material that might adversely affect the welding.

For production welding of materials with two separate strength levels, a procedure that is qualified for the higher-strength material should be used.

NOTE While it is acceptable (according to 5.6.2.3) for the measured tensile strength across the weld to be less than the actual tensile strength of the pipe material, some pipeline designs (e.g., high longitudinal strains due to geotechnical reasons) require matching or overmatching strength girth welds. The use of filler metal with yield strength that matches or overmatches the actual yield strength of the pipe material prevents longitudinal strains from accumulating in the weld region, which is more likely to contain imperfections than the pipe material.

7.2 Alignment

The root opening, or spacing between abutting members, shall be in accordance with the welding procedure specification. The alignment of abutting ends shall minimize the offset between surfaces. For pipe ends of the same OD and specified thickness, the offset at any location should not exceed $^{1}/_{8}$ in. (3 mm). Larger variations are permissible provided the variation is caused by variations of the pipe end dimensions within the pipe purchase specification tolerances, and such offset has been minimized by distributing around the

circumference of the pipe. Hammering of the pipe to obtain proper lineup should be kept to a minimum and hinging of the pipe joint (i.e., the use of hinge tacks) to achieve a proper root gap should be prohibited.

7.3 Use of Lineup Clamp for Butt Welds

Use and removal of lineup clamps shall be in accordance with the welding procedure specification. If the clamp can be removed prior to root pass completion, the percentage required by the welding procedure specification shall be met and should be equally spaced around the circumference.

7.4 Bevel

The bevels shall conform to the joint design used in the welding procedure specification.

7.5 Weather Conditions

Welding shall not be done when the quality of the completed weld would be impaired by the prevailing weather conditions, including but not limited to low temperatures, airborne moisture, blowing sands, or high winds. Windshields or temporary shelters may be used when practical. The company shall decide if weather conditions are suitable for welding.

7.6 Clearance

When the pipe is welded above ground, the working clearance around the pipe at the weld should not be less than 16 in. (400 mm). When the pipe is welded in a trench, the bell hole shall be large enough to provide the welder or welders with ready access to the joint.

7.7 Cleaning Between Beads

Scale and slag should be removed from each bead and groove. Power tools shall be used when called for in the welding procedure specification; otherwise, cleaning may be performed with either hand or power tools.

When semiautomatic or mechanized welding is used, surface porosity clusters, bead starts, and high points should be removed by grinding before weld metal is deposited over them. When requested by the company, heavy glass deposits shall be removed before weld metal is deposited over them.

7.8 Position and Roll Welding

7.8.1 Procedure

All position welds shall be made with the parts to be joined secured against movement and with adequate clearance around the joint to allow the welder or welders space in which to work. At the company's option, roll welding shall be permitted using a qualified welding procedure specification, provided alignment is maintained using skids or a structural framework with an adequate number of roller dollies to prevent sag in the supported lengths of pipe.

7.8.2 Filler and Finish Beads

The number of filler and finish beads shall allow the completed weld a substantially uniform cross-section around the entire circumference of the pipe. At no point shall the crown surface fall below the outside surface of the pipe, nor should it be raised above the parent metal by more than that specified in the welding procedure specification.

Two beads shall not be started at the same location. The cap width should conform to the tolerances specified in the welding procedure specification. The completed weld shall be thoroughly brushed and cleaned.

7.9 Identification of Welds

Each welder shall identify the welder's work in the manner agreed by the company.

7.10 Preheat, Interpass Temperature, Postheat, and PWHT

Preheat, interpass temperature, postheat, and PWHT practices as listed on the qualified welding procedure specification shall be followed.

NOTE Application of postheat can be beneficial to the reduction of solute hydrogen, particularly when using cellulosic-coated (AWS EXX10-type) electrodes.

8 Inspection and Testing of Production Welds

8.1 Rights of Inspection

The company shall have the right to inspect all welds by nondestructive means or by removing welds and subjecting them to mechanical tests. The inspection may be made during the welding or after the weld has been completed. The frequency of inspection shall be as specified by the company.

8.2 Methods of Inspection

The NDT method used shall produce indications of imperfections that can be accurately interpreted and evaluated. The welds shall be evaluated on the basis of either Section 9 or, at the company's option, Annex A. In the latter case, more extensive inspection to determine the imperfection size is required.

Destructive testing shall consist of the removal of completed welds, sectioning of the welds into specimens, and the examination of the specimens. The specimens shall be prepared in accordance with and shall meet the requirements of 6.5. The company shall have the right to accept or reject any weld that does not meet the requirements for the method by which it was inspected.

NOTE 1 The welder who makes a weld that fails to comply with the requirements may be disqualified from further work.

NOTE 2 Operators of nondestructive inspection equipment may be required to demonstrate the inspection procedure's capability to detect defects and the operator's ability to properly interpret the indications given by the equipment.

Trepanning methods of testing shall not be used.

8.3 Qualification of Inspection Personnel

Welding inspection personnel shall be qualified by experience and training for the specified inspection task they perform. Their qualifications shall be acceptable to the company.

Documentation of these qualifications shall be retained by the company and shall include but is not limited to the following:

a) education and experience;

b) training;

c) results of any qualification examinations.

8.4 Certification of NDT Personnel

8.4.1 Procedures

NDT personnel shall be certified to Level I, II, or III in accordance with the recommendations of ASNT SNT-TC-1A, ASNT ACCP[7], or any other recognized national certification program that shall be acceptable to the company for the test method used. Only Level II or III personnel shall interpret test results.

8.4.2 Record

A record of certified NDT personnel shall be maintained by the company. The record shall include the results of certification tests, the agency and person granting certification, and the date of certification.

NOTE NDT personnel may be required to be recertified at the company's option or if any question arises about their ability.

All levels of NDT personnel shall be recertified at least every five years.

8.4.3 Vision Examinations

8.4.3.1 Near Distance

All NDT personnel shall be examined to ensure that they have natural or corrected near-distance acuity in at least one eye such that each individual is capable of reading a Jaeger No. 1 test chart or equivalent at a distance of not less than 12 in. (300 mm). Non-NDT personnel (i.e., welding inspectors) who perform visual inspections shall be examined to ensure that they have natural or corrected near-distance acuity in at least one eye such that each individual is capable of reading a Jaeger No. 2 test chart or equivalent at a distance of not less than 12 in. (300 mm).

8.4.3.2 Color Vision

NDT personnel for all methods shall demonstrate the ability to differentiate among the colors or shades of gray used in the method.

8.4.3.3 Frequency

Near-vision examinations shall be administered at least annually for NDT personnel and every three years for non-NDT personnel. Color differentiation examinations shall be repeated at least every five years.

9 Acceptance Standards for NDT

9.1 General

The acceptance standards presented in this section apply to imperfections located by radiographic, magnetic particle, liquid penetrant, and ultrasonic test methods. They may also be applied to visual inspection. NDT shall not be used to select welds/weld specimens that are subjected to destructive testing in accordance with 6.5.

9.2 Rights of Rejection

All nondestructive test methods are limited in the information that can be derived from the indications they produce, and the company may therefore reject any weld that appears to meet these acceptance standards if, in its opinion, the depth of an imperfection may be detrimental to the weld.

[7] ASNT Central Certification Program, American Society for Nondestructive Testing, www.asnt.org.

9.3 Radiographic Testing

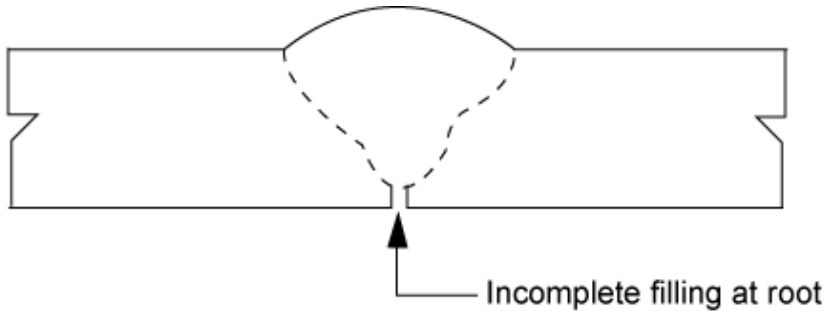
9.3.1 Inadequate Penetration Without High-low (IP)

IP, as defined in 3.1.22 and shown schematically in Figure 14, shall be considered a defect should any of the following conditions exist:

a) the length of an individual indication of IP exceeds 1 in. (25 mm);

b) the aggregate length of indications of IP in any continuous 12-in. (300-mm) length of weld exceeds 1 in. (25 mm);

c) the aggregate length of indications of IP exceeds 8 % of the weld length in any weld less than 12 in. (300 mm) in length.



NOTE One or both root faces may be inadequately filled at the inside surface.

Figure 14—Inadequate Penetration Without High-low

9.3.2 Inadequate Penetration Due to High-low (IPD)

IPD, as defined in 3.1.21 and shown schematically in Figure 15, shall be considered a defect should any of the following conditions exist:

a) the length of an individual indication of IPD exceeds 2 in. (50 mm);

b) the aggregate length of indications of IPD in any continuous 12-in. (300-mm) length of weld exceeds 3 in. (75 mm).

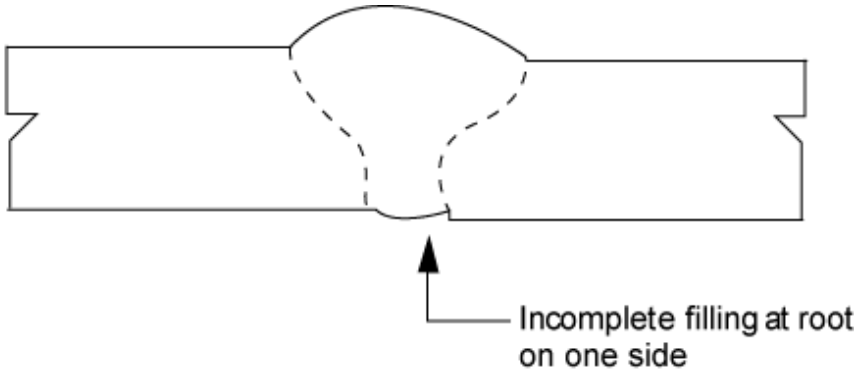


Figure 15—Inadequate Penetration Due to High-low

9.3.3 Inadequate Cross Penetration (ICP)

ICP, as defined in 3.1.20 and shown schematically in Figure 16, shall be considered a defect should any of the following conditions exist:

a) the length of an individual indication of ICP exceeds 2 in. (50 mm);

b) the aggregate length of indications of ICP in any continuous 12-in. (300-mm) length of weld exceeds 2 in. (50 mm).

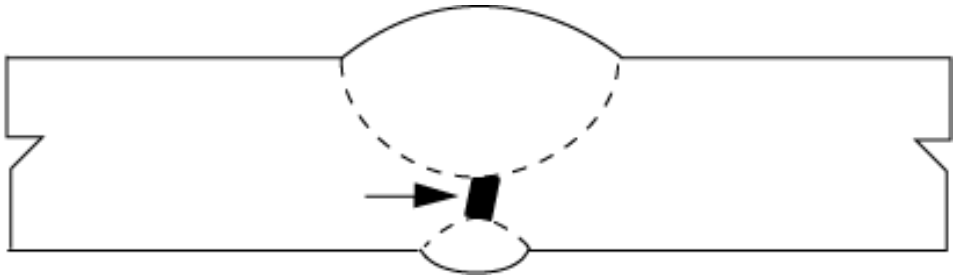


Figure 16—Inadequate Cross Penetration

9.3.4 Incomplete Fusion (IF)

IF, as defined in 3.1.23 and shown schematically in Figure 17, shall be considered a defect should any of the following conditions exist:

a) the length of an individual indication of IF exceeds 1 in. (25 mm);

b) the aggregate length of indications of IF in any continuous 12-in. (300-mm) length of weld exceeds 1 in. (25 mm);

c) the aggregate length of indications of IF exceeds 8 % of the weld length in any weld less than 12 in. (300 mm) in length.

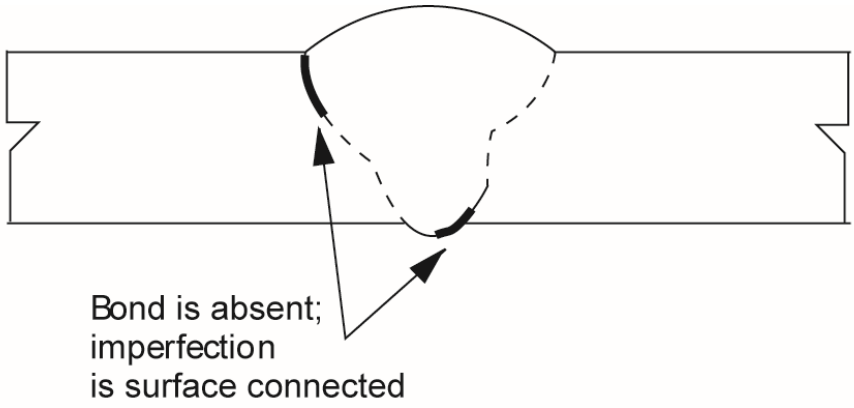


Figure 17—Incomplete Fusion at Root of Bead or Top of Joint

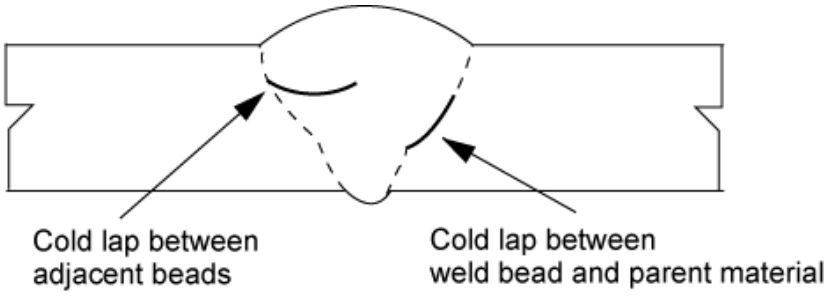
9.3.5 Incomplete Fusion Due to Cold Lap (IFD)

IFD, as defined in 3.1.24 and shown schematically in Figure 18, shall be considered a defect should any of the following conditions exist:

a) the length of an individual indication of IFD exceeds 2 in. (50 mm);

b) the aggregate length of indications of IFD in any continuous 12-in. (300-mm) length of weld exceeds 2 in. (50 mm);

c) the aggregate length of indications of IFD exceeds 8 % of the weld length.



NOTE The cold lap shown is not surface connected.

Figure 18—Incomplete Fusion Due to Cold Lap

9.3.6 Internal Concavity (IC)

IC, as defined in 3.1.28 and shown schematically in Figure 19, of any length shall be acceptable, provided the density of the radiographic image of the IC does not exceed that of the thinnest adjacent parent material. For any areas that exceed the density of the thinnest adjacent parent material, the IC shall be considered a defect.

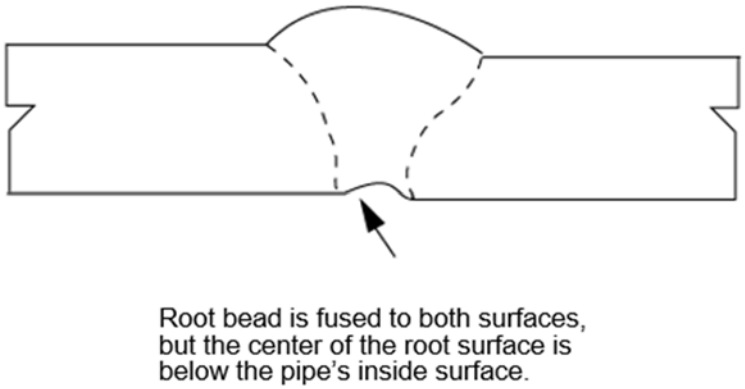


Figure 19—Internal Concavity

9.3.7 Burn-through (BT)

BT, as defined in 3.1.5, shall be considered a defect when a portion of the area is thinner than the thinnest adjacent parent material.

9.3.8 Slag Inclusions

9.3.8.1 General

Slag inclusion is defined in 3.1.54. Elongated slag inclusions (ESIs)—for example, continuous or broken slag lines or wagon tracks—are found at the fusion zones. Isolated slag inclusions (ISIs) are irregularly shaped and may be located anywhere in the weld.

For evaluation purposes, when the size of a radiographic indication of slag is measured, the indication's maximum dimension shall be considered its length.

9.3.8.2 Pipe Diameter—2.375 in. (60.3 mm) or Greater

For pipe with a specified OD greater than or equal to 2.375 in. (60.3 mm), slag inclusions shall be considered a defect should any of the following conditions exist:

a) the length of an ESI indication exceeds 2 in. (50 mm);

b) parallel ESI indications separated by approximately the width of the root bead (wagon tracks) shall be considered a single indication unless the width of either of them exceeds $^1/_{32}$ in. (0.8 mm). In that event, they shall be considered separate indications;

c) the aggregate length of ESI indications in any continuous 12-in. (300-mm) length of weld exceeds 2 in. (50 mm);

d) the width of an ESI indication exceeds $^1/_{16}$ in. (1.6 mm);

e) the aggregate length of ISI indications in any continuous 12-in. (300-mm) length of weld exceeds $^1/_2$ in. (13 mm);

f) the width of an ISI indication exceeds $^1/_8$ in. (3 mm);

g) more than four ISI indications with the maximum width of $^1/_8$ in. (3 mm) are present in any continuous 12-in. (300 mm) length of weld;

h) the aggregate length of ESI and ISI indications exceeds 8 % of the weld length.

9.3.8.3 Pipe Diameter—Less than 2.375 in. (60.3 mm)

For pipe with a specified OD less than 2.375 in. (60.3 mm), slag inclusions shall be considered a defect should any of the following conditions exist:

a) the length of an ESI indication exceeds three times the thinner of the specified wall thicknesses joined;

b) parallel ESI indications separated by approximately the width of the root bead (wagon tracks) shall be considered a single indication unless the width of either of them exceeds $^1/_{32}$ in. (0.8 mm). In that event, they shall be considered separate indications;

c) the width of an ESI indication exceeds $^1/_{16}$ in. (1.6 mm);

d) the aggregate length of ISI indications exceeds two times the thinner of the specified wall thicknesses joined and the width exceeds one-half the thinner of the specified wall thicknesses joined;

e) the aggregate length of ESI and ISI indications exceeds 8 % of the weld length.

9.3.9 Porosity

9.3.9.1 General

Porosity, as defined in 3.1.35, is generally spherical but may be elongated or irregular in shape, such as wormhole porosity, and when the size of the indication produced by a pore is measured, the maximum dimension of the indication shall apply to the criteria given in 9.3.9.2 or 9.3.9.3.

9.3.9.2 Individual or Scattered Porosity

Individual or scattered porosity shall be considered a defect should any of the following conditions exist:

a) the size of an individual pore exceeds $^1/_8$ in. (3 mm) in diameter or 25 % of the specified wall thickness, whichever is less;

b) the size of an individual pore exceeds 25 % of the thinner of the two specified wall thicknesses joined, but no more than $^1/_8$ in. (3 mm) in diameter;

c) the distribution of scattered porosity exceeds the concentration permitted by Figure 20 or Figure 21.

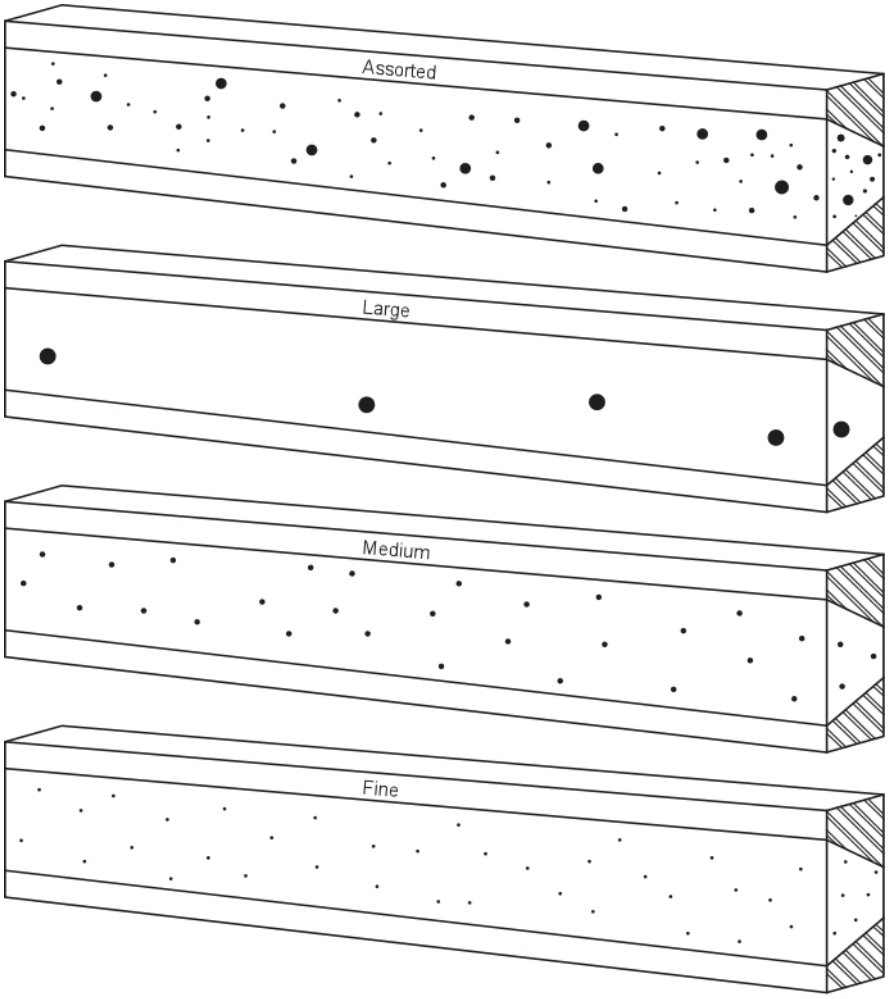


Figure 20—Maximum Distribution of Gas Pockets: Wall Thickness (*t*) less than or equal to 0.500 in. (12.7 mm)

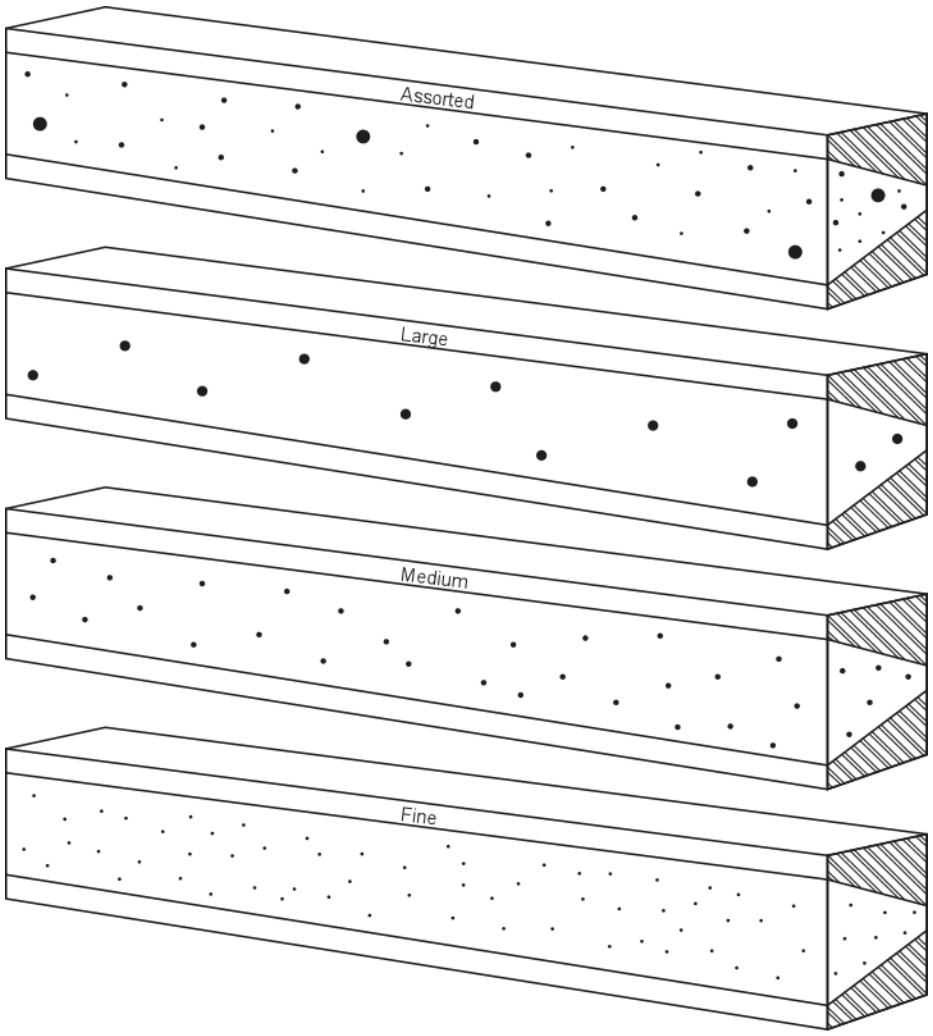


Figure 21—Maximum Distribution of Gas Pockets: Wall Thickness (*t*) Greater Than 0.500 in. (12.7 mm)

9.3.9.3 Hollow Bead (HB) Porosity

HB, as defined in 3.1.18, shall be considered a defect should any of the following conditions exist:

a) the length of an individual indication of HB exceeds 1 in. (25 mm);

b) the aggregate length of indications of HB in any continuous 12-in. (300-mm) length of weld exceeds 2 in. (50 mm);

c) the aggregate length of all indications of HB exceeds 8 % of the weld length.

9.3.10 Cracks

Cracks shall be considered a defect should any of the following conditions exists:

a) the crack, of any size or location in the weld, is not a crater crack or star crack;

b) the crack is a crater crack or star crack with a length that exceeds $^{5}/_{32}$ in. (4 mm).

NOTE Crater cracks or star cracks are located at the stopping point of weld beads and are the result of weld metal contractions during solidification.

9.3.11 Undercutting

Undercutting, as defined in 3.1.59, adjacent to the cover pass (EU) or undercutting adjacent to the root bead (IU) shall be considered a defect when either of the following conditions exists:

a) the aggregate length of indications of EU and IU, in any combination, in any continuous 12-in. (300-mm) length of weld exceeds 2 in. (50 mm);

b) the aggregate length of indications of EU and IU, in any combination, exceeds one-sixth of the weld length.

NOTE See 9.7 for acceptance standards for undercutting when visual and mechanical measurements are employed.

9.3.12 Accumulation of Imperfections

Excluding inadequate penetration due to high-low and undercutting, any accumulation of imperfections shall be considered a defect should any of the following conditions exist:

a) the aggregate length of indications in any continuous 12-in. (300-mm) length of weld exceeds 2 in. (50 mm);

b) the aggregate length of indications exceeds 8 % of the weld length.

9.3.13 Base Material Imperfections

Imperfections in the base material and/or seam welds detected by radiographic testing shall be reported to the company. The disposition of these imperfections shall be as directed by the company.

9.4 Magnetic Particle Testing

9.4.1 Classification of Indications

Indications produced by magnetic particle testing are not necessarily imperfections. Magnetic and metallurgical variations may produce indications that are like those produced by imperfections but that are not relevant to acceptability.

The following criteria shall apply when indications are evaluated.

a) Any indication with a maximum dimension of $^{1}/_{16}$ in. (1.6 mm) or less shall be classified as nonrelevant. Any larger indication believed to be nonrelevant shall be regarded as relevant until reexamined by magnetic particle or another NDT method to determine whether or not an actual imperfection exists. The surface may be ground or otherwise conditioned before reexamination. After an indication is determined to be nonrelevant, other nonrelevant indications of the same type need not be reexamined.

b) Relevant indications are those caused by imperfections.

9.4.2 Acceptance Standards

Linear indications are defined in 3.1.30. Rounded indications are defined in 3.1.51. Transverse indications are defined in 3.1.58.

Relevant indications shall be considered defects should any of the following conditions exist:

a) indications evaluated as crater cracks or star cracks exceed $^{5}/_{32}$ in. (4 mm) in length;

b) indications evaluated as cracks other than crater cracks or star cracks;

c) linear indications evaluated as IF and exceed 1 in. (25 mm) in total length in a continuous 12-in. (300-mm) length of weld or 8 % of the weld length.

Rounded indications shall be evaluated according to the criteria of 9.3.9.2 and 9.3.9.3, as applicable. For evaluation purposes, the maximum dimension of a rounded indication shall be considered its size.

NOTE When doubt exists about the type of imperfection being disclosed by an indication, verification may be obtained by using other NDT methods.

9.4.3 Base Material Imperfections

Imperfections in base material and/or seam welds detected by magnetic particle testing shall be reported to the company. The disposition of these imperfections shall be as directed by the company.

9.5 Liquid Penetrant Testing

9.5.1 Classification of Indications

Indications produced by liquid penetrant testing are not necessarily imperfections. Machining marks, scratches, and surface conditions may produce indications that are similar to those produced by imperfections but that are not relevant to acceptability. The following criteria shall apply when indications are evaluated.

a) Any indication with a maximum dimension of $^{1}/_{16}$ in. (2 mm) or less shall be classified as nonrelevant. Any larger indication believed to be nonrelevant shall be regarded as relevant until reexamined by liquid penetrant or another NDT method to determine whether or not an actual imperfection exists. The surface may be ground or otherwise conditioned before reexamination. After an indication is determined to be nonrelevant, other nonrelevant indications of the same type need not be reexamined.

b) Relevant indications are those caused by imperfections.

9.5.2 Acceptance Standards

Linear indications are defined in 3.1.30. Rounded indications are defined in 3.1.51. Transverse indications are defined in 3.1.58.

Relevant indications shall be considered defects should any of the following conditions exist:

a) indications evaluated as crater cracks or star cracks exceed $^{5}/_{32}$ in. (4 mm) in length;

b) indications evaluated as cracks other than crater cracks or star cracks;

c) linear indications evaluated as IF and exceed 1 in. (25 mm) in total length in a continuous 12-in. (300-mm) length of weld or 8 % of the weld length.

Rounded indications shall be evaluated according to the criteria of 9.3.9.2 and 9.3.9.3, as applicable. For evaluation purposes, the maximum dimension of a rounded indication shall be considered its size.

NOTE When doubt exists about the type of imperfection being disclosed by an indication, verification may be obtained by using other NDT methods.

9.5.3 Base Material Imperfections

Imperfections in the base material and/or seam welds detected by liquid penetrant testing shall be reported to the company. The disposition of these imperfections shall be as directed by the company.

9.6 Ultrasonic Testing

9.6.1 Classification of Indications

9.6.1.1 General

Indications produced by ultrasonic testing are not necessarily imperfections. Changes in the weld geometry due to alignment offset of abutting pipe ends, changes in weld reinforcement profile of ID root and OD capping passes, internal chamfering, and ultrasonic wave mode conversion due to such conditions may cause geometric indications that are similar to those caused by weld imperfections but that are not relevant to acceptability.

9.6.1.2 Linear Indications

Typical linear indications may be caused by, but are not limited to, the following types of imperfections: IP, IPD, ICP, IF, IFD, ESI, cracks, EU, IU, and HB.

9.6.1.3 Transverse Indications

Typical transverse indications may be caused by, but are not limited, to the following types of imperfections: cracks, ISIs, and IFD at start/stops in the weld passes.

9.6.1.4 Volumetric Indications

Volumetric indications may be caused by single or multiple inclusions, voids, or pores. Partially filled voids, pores, or small inclusions at start/stops in weld passes may cause larger indications in the transverse direction than in the weld length direction. Typical volumetric indications may be caused by, but are not limited to, the following types of imperfections: IC, BT, ISIs, porosity, and CP.

9.6.1.5 Relevant Indications

Relevant indications are those caused by imperfections. Relevant indications shall be evaluated as per the requirements defined in the ultrasonic testing procedure.

NOTE When doubt exists about the type of imperfection being disclosed by an indication, verification may be obtained by using other NDT methods.

9.6.2 Acceptance Standards

9.6.2.1 General

Indications shall be considered defects should any of the following conditions exist:

a) indications determined to be cracks;

b) individual indications with a vertical height (through-wall) dimension determined to be greater than one-quarter of the wall thickness;

c) multiple indications at the same circumferential location with a summed vertical height (through-wall) dimension exceeding one-quarter the wall thickness.

9.6.2.2 Linear Surface (LS) Indications

LS indications (other than cracks) interpreted to be open to the ID or OD surface shall be considered defects should any of the following conditions exist:

a) the aggregate length of LS indications in any continuous 12-in. (300-mm) length of weld exceeds 1 in. (25 mm);

b) the aggregate length of LS indications exceeds 8 % of the weld length.

9.6.2.3 Linear Buried (LB) Indications

LB indications (other than cracks) interpreted to be subsurface within the weld and not ID or OD surface connected shall be considered defects should any of the following conditions exist:

a) the aggregate length of LB indications in any continuous 12-in. (300-mm) length of weld exceeds 2 in. (50 mm);

b) the aggregate length of LB indications exceeds 8 % of the weld length.

9.6.2.4 Transverse (T) Indications

T indications (other than cracks) shall be considered volumetric and evaluated using the criteria for volumetric indications. The letter T shall be used to designate all reported transverse indications.

9.6.2.5 Volumetric Cluster (VC) Indications

VC indications shall be considered defects when the maximum dimension of VC indications exceeds ½ in. (13 mm).

9.6.2.6 Volumetric Individual (VI) Indications

VI indications shall be considered defects when the maximum dimension of VI indications exceeds 1/8 in. (3 mm).

9.6.2.7 Volumetric Root (VR) Indications

VR indications interpreted to be open to the ID surface shall be considered defects should any of the following conditions exist:

a) the maximum dimension of VR indications exceeds 1/4 in. (6 mm) or the specified wall thickness, whichever is less;

b) the total length of VR indications exceeds 1/2 in. (13 mm) in any continuous 12-in. (300-mm) length.

9.6.2.8 Accumulation

Any accumulation of relevant indications shall be considered a defect when any of the following conditions exist:

a) the aggregate length of indications above evaluation level exceeds 2 in. (50 mm) in any 12-in. (300-mm) length of weld;

b) the aggregate length of indications above evaluation level exceeds 8 % of the weld length.

9.6.3 Base Material Imperfections

Imperfections in the base material and/or seam weld detected by ultrasonic testing shall be reported to the company. The disposition of these imperfections shall be as directed by the company.

9.7 Visual Acceptance Standards for Undercutting

9.7.1 General

Undercutting is defined in 3.1.59. The acceptance standards in 9.7.2 supplement but do not replace visual inspection requirements found elsewhere in this standard.

9.7.2 Acceptance Standards

When visual and mechanical means are used to determine depth, undercutting adjacent to the cover or root bead shall not exceed the dimensions given in Table 8. When both mechanical and radiographic measurements are available, the mechanical measurements shall govern.

Table 8—Maximum Dimensions of Undercutting

Depth	Length
> $^{1}/_{32}$ in. (0.8 mm) or > 12.5 % of pipe wall thickness, whichever is smaller	Not acceptable
> $^{1}/_{64}$ in. (0.4 mm) but ≤ $^{1}/_{32}$ in. (0.8 mm) or > 6 % but ≤ 12.5 % of pipe wall thickness, whichever is smaller	2 in. (50 mm) in a continuous 12-in. (300-mm) weld length or one-sixth the weld length, whichever is smaller
≤ $^{1}/_{64}$ in. (0.4 mm) or ≤ 6 % of pipe wall thickness, whichever is smaller	Acceptable, regardless of length

9.8 Visual Acceptance Standards for Internal Concavity

9.8.1 General

Internal concavity (IC) is defined in 3.1.28. The acceptance standards in 9.8.2 supplement but do not replace visual inspection requirements found elsewhere in this standard.

9.8.2 Acceptance Standards

When IC is detected by visual examination, any length of IC shall be considered a defect should the depth of the concavity be greater than the cap height at the same location relative to the length of the weld.

10 Repair and Removal of Weld Defects

10.1 General

Weld defects identified during visual inspection, nondestructive testing, or during the company's review of nondestructive testing results shall be repaired.

The full length of the defect being repaired in a single repair area shall be removed and repaired as part of the repair weld process; intentional partial repair of a defect is prohibited. However, if part of the original defect remains after repair and the repair weld meets the acceptance criteria of Section 9, the repair weld shall be considered acceptable. New indications introduced by the repair weld shall be acceptable if the acceptance criteria is satisfied. Defects rejected by Annex A shall be repaired along the full length of the identified defect.

10.2 Repair Requirements

10.2.1 Company Authorization Requirements

Company authorization shall not be required for any repairs that do not involve the application of heat or weld metal, such as grinding, filing, etc.

Company authorization shall be required for the following:

a) crack repair;

b) back weld repair;

c) double repair; and

d) repair of a weld in pipe with a specified OD less than 2.375 in. (60.3 mm).

Unless mandated by the company, authorization is not required for any other type of repair.

10.2.2 Repair Procedure Application Requirements

A qualified repair procedure shall be required whenever a repair is made by welding when:

a) using a welding procedure different from that used to make the original weld;

b) repairs are made in a previously repaired area (double repair);

c) a crack(s) is repaired;

d) a back weld repair when a back weld was not part of the original welding procedure; or

e) required by the company.

A repair procedure qualified for a double repair shall be acceptable to use for a single repair. A repair procedure that is qualified for a repair of a weld with a crack shall be acceptable to use to repair other defect types.

10.2.3 Crack Repairs

A weld containing a crack defect(s) shall either be repaired or cut out. Crater or star crack defect(s) found and contained completely in internal or external weld reinforcement may be repaired by grinding (i.e., abrasive methods) without a qualified repair procedure. If grinding to remove a crater or star crack defect(s) exceeds the internal or external reinforcement, the reinforcement shall be replaced using a qualified welding procedure. A cut-out is required when either of the following conditions exist.

a) A weld with a crack defect, as defined by 9.3.10, shall be cut out when the length of a single crack or the aggregate length of more than one crack is greater than 8 % of the weld length. The length of a crack is the longest dimension regardless of orientation.

b) A double repair of a crack is not permitted. Additional cracking in the weld area after repair shall require a cut-out.

10.2.4 Multiple Repairs in a Repair Area

Only two repairs to the same repair area (i.e., double repair) shall be allowed unless authorized by the company and repaired with a qualified repair procedure appropriate for the number of thermal cycles subjected to the weld and base metal.

NOTE A grinding repair is not considered to be one of the thermal cycles.

10.2.5 Repairs by Grinding

Repairs made only by grinding shall only be used to remove defects provided that:

a) pipe surface contour and minimum design wall/weld thickness requirements are not violated; and

b) defect removal is restricted to the reinforcement height of root bead and cover passes when the minimum design wall/weld thickness value is not known.

NOTE Grinding repair lengths and the number of grinding repair areas are not limited. Grinding repairs do not require use of a qualified repair procedure.

10.2.6 Repair Area Length

10.2.6.1 Maximum Deposited Repair Area Length

The maximum deposited repair area length shall be measured at the base metal surface.

The length of any individual repair area or total length of all accumulated repair areas within a completed weld shall not exceed a percentage of weld length specified by the company.

10.2.6.2 Minimum Deposited Repair Area Length

The minimum deposited repair area length shall be measured at the deepest part of the repair area.

All repair areas shall have a length of at least 2 in. (50 mm) or as otherwise specified by the company.

10.3 Repair Procedure

10.3.1 General

When a repair procedure is required, the procedure shall be established and qualified to demonstrate that a repair weld with suitable mechanical properties and soundness can be produced. The repair weld shall meet the minimum requirements of the production weld or as otherwise specified by the company.

10.3.2 Types of Repair Procedures

Types of repair procedures include but are not limited to the following:

a) full-thickness repair;

b) internal partial-thickness repair;

c) external partial-thickness repair;

d) cover pass repair;

e) back weld repair.

10.3.3 Specification Information

Repair weld procedures shall be revised to show any changes and shall include the following.

a) welding processes and other specification information contained in 5.3.2, to include with the following addition:

When one repair type is used to qualify another (e.g., full-thickness to qualify partial or cover pass repair in accordance with Table 10), initial welding process(es) or filler metal classification(s) may be eliminated when the welding procedure is used to apply another repair type. When this is applicable, the welding procedure shall specify the welding process and filler metal classifications to be used for each repair type;

b) when the application of the repair procedure requires company approval;

c) repair type;

d) location; identify excavation location at weld centerline and/or fusion line;

e) method of defect removal (i.e., grinding, arc-gouging, filing, etc.);

f) method of inspection by which the repair groove shall be examined;

g) requirements for preheat and interpass temperature (minimum/maximum), method of application, and location or area;

h) requirement, if any, for interpass NDT;

i) methods (i.e., storage, handling, usage) to control filler metals, fluxes, and shielding gases when hydrogen control is required;

j) maximum and minimum repair area length;

k) minimum time delay, if any, before final inspection;

l) revision identifier.

10.3.4 Essential Variables

A repair procedure shall be reestablished as a new repair procedure and shall be requalified when any of the essential variables listed in Table 1 or those shown in Table 9 are changed. Essential variables as listed in Table 9 supersede those listed in Table 1 when any conflict exists. Essential variables in Table 1 and Table 9 shall apply to the repair weld only, not the original production weld.

The variables and qualification ranges specified in Table 9 are classified as two categories. Category I essential variables shall apply for all repair welding procedures. Category II essential variables shall apply when the system design requires hardness and/or toughness limits.

Table 9—Essential Variables for Qualification of Repair Welding Procedure Specifications

Welding Variable Subsection[a]	Change Requiring Requalification	Category I (Standard WPSs)	Category II (Hardness and/or Toughness)
10.3.4.1 Welding Process or Filler Metal [b]	A change from the repair welding process or method of application (e.g., manual or semiautomatic) established in the welding procedure specification constitutes an essential variable. If a specific welding process or consumable for a pass or pass grouping is not used as allowed by 10.3.3 a), this process or consumable shall not be used in the repair weld.	X	X
10.3.4.2 Type of Repair [c, d]	Any change from a repair type listed in 10.3.2 to another, except as provided in Table 10.	X	X
10.3.4.3 Repair with Multiple or Single Beads	A change from multiple bead repair to single weld bead repair.		X
10.3.4.4 Location of Excavation	a) A change from centerline to fusion line location for excavation of partial-thickness repairs.		X
	b) A change from centerline to fusion line location for cover pass repairs.		X
10.3.4.5 Bevel Angle	A change in bevel geometry by more than ± 25 % from that qualified.	X	X

NOTE Welding into or over self-shielded flux-cored arc welding (FCAW-S) weld metal with a process other than FCAW-S may result in reduced weld metal toughness or other issues. Some FCAW-S consumables are only meant for single pass welding (e.g., AWS usability designator 3, 10, 13, 14, GS).

[a] The subsection numbers in this column are provided for referencing purposes.

[b] For example, a full-thickness repair welding procedure qualified using E6010 for the root and second (hot) pass, and E7018 for the remaining passes, may be used to make a partial-thickness repair only using E7018 filler metal.

[c] Repair types qualified on a butt joint qualify branch and fillet weld joint designs in addition to a butt joint design.

[d] See Table 10 for 10.3.4.2.

Table 10—Repair Type Qualification Matrix

Repair Type Performed During Qualification	Repair Type Qualified				
	Full-Thickness	External Partial-thickness	Internal Partial-thickness	Cover Pass	Back Weld
Full-thickness	X	X	X	X	X[a]
External partial-thickness		X	X[a]	X	X[a]
Internal partial-thickness		X[a]	X	X[a]	X
Back weld				X[a]	X
Cover pass				X	X[a]

NOTE Repair types are independent of joint type (i.e., butt weld repair qualifications can be applied to fillet and branch joint designs); all tests shall be carried out on butt welds.

[a] For Category II per Table 9, this option is not permitted.

10.3.5 Welding of Test Joints

Repair procedures shall be qualified on a test weld completed following the details of a production welding procedure specification. A full circumferential butt weld shall be used to qualify a repair procedure. Multiple repair procedures may be qualified on a single production weld in location(s) specified by the company provided each repair weld is a minimum of 8 in. (203 mm) in length, measured at the bottom of the repair groove. Length shall be sufficient for all test specimens.

NOTE A single full-circumference test weld joint may be used to qualify more than one type of repair procedure (i.e., more than one repair weld can be made in a single butt weld to qualify multiple repair procedures provided all required test specimens are taken from each repair type).

Details for each repair procedure shall be recorded with the complete results in the procedure qualification record.

At a minimum, the data and information documenting the observed values of essential variables for the repair weld used during qualification testing shall be recorded. A form similar to that shown in Figure 1 should be used. The record shall be maintained as long as the procedure is in use.

10.3.6 Testing of Repair Welds

10.3.6.1 General

Repair procedures shall be qualified by visual and destructive testing. For repair procedure qualification, sample preparation and destructive and visual testing shall not commence until the repair weld has been allowed to cool to ambient temperature. Accelerated cooling may not be used to reduce the time for the weld to cool to ambient temperature unless deliberate cooling is a requirement of the WPS.

The minimum total number of specimens and the types of destructive tests to which each repair procedure shall be submitted are shown in Table 11. At the discretion of the company, additional types and number of tests may be required. The repair welder and repair welding procedure may be qualified simultaneously, provided two nick breaks are added in the locations as specified by Table 14.

When the production weld that is to be repaired has toughness requirements, the repair procedure shall demonstrate the ability to meet those same requirements. This may be demonstrated through Charpy impact testing or other testing as specified by the company. This requirement applies to partial-thickness and full-thickness repair procedures only.

When the production weld that is to be repaired has hardness requirements, the repair procedure should demonstrate the ability to meet those same requirements.

NOTE 1 Dependent on pipe material and/or welding process, the company may require additional cooling time or a delay prior to destructive and visual testing.

NOTE 2 Thermal cycles can affect base material properties, particularly yield and tensile strength in the HAZ, which may differ between materials that were manufactured differently and/or have different chemical compositions.

Table 11—Type and Number of Butt Weld Test Specimens per Repair Type for Repair Procedure Qualification

Repair Type	Tensile Strength	Root Bend	Face Bend	Side Bend	Total (Minimum)
Nominal Wall Thickness ≤ 0.500 in. (12.7 mm)					
Full-thickness	1	1	1	0	3
Internal partial-thickness	1	0	1 [a]	0	2
External partial-thickness	1	0	1	0	2
Cover pass	0	0	1	0	1
Back weld	0	0	1 [a]	0	1
Nominal Wall Thickness > 0.500 in. (12.7 mm)					
Full-thickness	1	0	0	2	3
Internal partial-thickness	1	0	0	1	2
External partial-thickness	1	0	0	1	2
Cover pass	0	0	0	1	1
Back weld	0	0	0	1	1
NOTE 1 Hardness testing is required when performed for the original weld procedure. NOTE 2 Charpy impact testing is required when performed for the original weld procedure.					
[a] The weld face is located on the inside (concave side) of the pipe.					

10.3.6.2 Tensile and Bend Tests

The test specimen preparation, test method, and acceptance requirements in 5.6 for tensile and bend tests shall be used for repair welds, except that test specimens shall be cut from the joint at each of the repair area locations.

The test specimens may be taken from the repair weld in any order; a specific sequence is not specified.

10.3.6.3 Charpy Impact Tests

10.3.6.3.1 General

When required by 10.3.6.1, Charpy impact testing shall be performed at locations in the weld as specified by the company.

10.3.6.3.2 Preparation

When Charpy impact testing is required by Table 11, both the weld metal and the HAZ shall be tested. Each test (of weld metal or HAZ) shall consist of at least three valid specimens. The exact size of the specimens depends on the weld thickness, but the largest possible size shall be selected. The thickness of subsized specimens should have at least 80 % of the wall thickness of the test coupon. The specimens shall be machined and notched in accordance with ASTM E23. The notch shall be oriented in the through-thickness direction as shown in Figure A.2 in Annex A or as specified by the company.

10.3.6.3.3 Testing

All specimens for each notch location (weld metal or HAZ) shall be tested at or below the minimum design temperature in accordance with the requirements of ASTM E23 or as otherwise directed by the company.

NOTE When a minimum fracture surface shear area percentage is specified, test temperatures lower than the design temperature may be necessary when the Charpy specimen size is significantly smaller than the pipe wall thickness.

10.3.6.3.4 Requirements

The minimum average value of a set and minimum individual value of impact energy for each set of three specimens shall not be less than the minimum values specified for qualification of the production weld or as otherwise specified by the company. Retesting is permitted when no more than one specimen fails and when approved by the company. When retesting is performed a new set of three test specimens shall be extracted from a location as close as possible to the location of the specimens that generated the low result. The absorbed energy of all three retest specimens shall meet or exceed the average absorbed energy requirement of the original specimens.

10.3.6.4 Hardness Tests

10.3.6.4.1 General

This section shall only apply when hardness testing is required by 10.3.6.1.

10.3.6.4.2 Preparation

Transverse sections shall be cut suitable for visual examination of the repair weld and adjacent base metal, and for a hardness survey. The specimen for the hardness test should have a thickness of at least ½ in. (13 mm). The specimen may be machine cut, or cut oversized using a thermal process and machined by a nonthermal process to remove at least ¼ in. (6 mm) from the side(s) that will be prepared. At least one face should be ground and polished to at least a 600 grit finish and etched with a suitable etchant such as Nital, ammonium persulfate, or dilute hydrochloric acid to give a clear definition of the weld structure.

10.3.6.4.3 Visual Examination

The macrosection shall be visually examined with lighting that will sufficiently reveal details of the weld soundness.

For the repair welding procedure to be considered acceptable, a visual examination of the macrosection shall show that the repair weld portion of the completed weld is completely fused to the adjacent base metal and/or weld metal at the root and between weld passes, and is free of cracks. Any other defects associated with the repair weld shall be within the applicable individual size limits specified in Section 9. A cross-section showing defects that are not associated with the repair weld portion of the completed weld shall not disqualify the test.

10.3.6.4.4 Testing

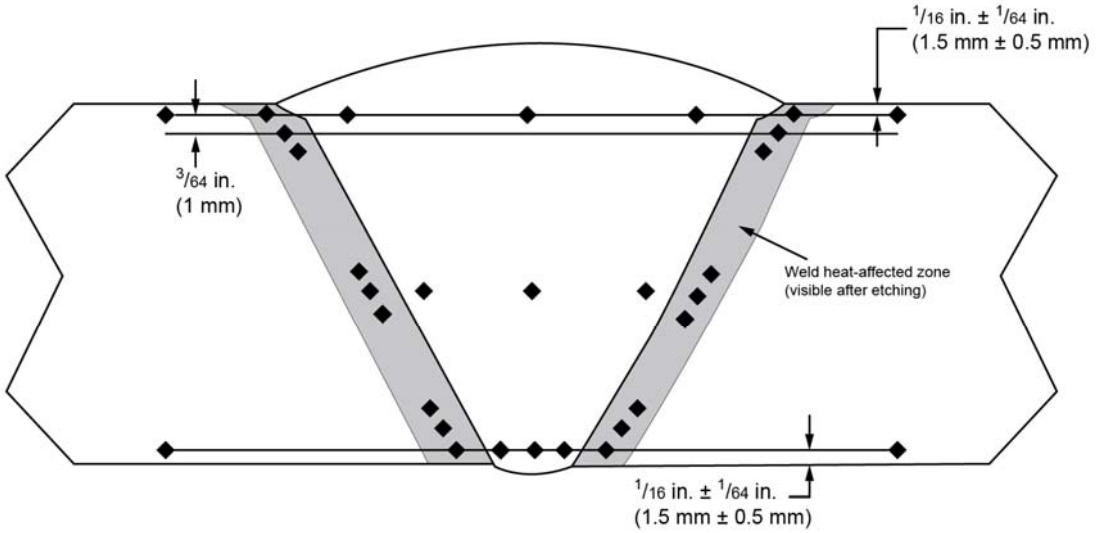
The macrosection test specimen shall be prepared for hardness testing in accordance with ASTM E384 or as otherwise directed by the company. The required number of indentations shall be made using a Vickers indenter using a 10-kg load or less. Locations shall be as shown in Figures 22 through 27, or at locations otherwise specified by the company. HAZ hardness impressions shall be entirely within the HAZ and located as close as possible to the fusion boundary (between the weld metal and HAZ).

If subsequent repairs (e.g., double repair) are qualified, the company may use the hardness test location provided here or specify other locations.

The wall thickness of the test coupon may restrict the total number of indents that are specified in the figures below. The number of indents should be reduced as needed to maintain indent spacing.

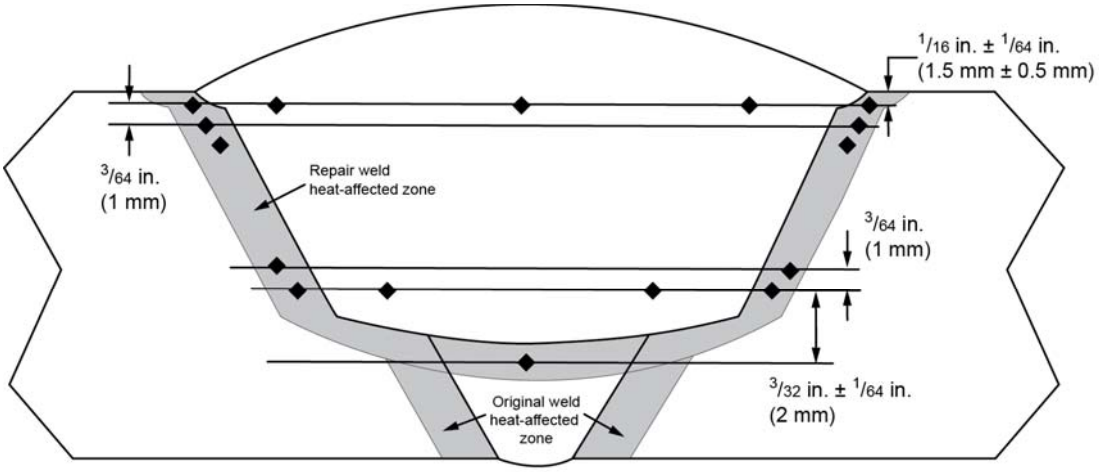
Maximum hardness values for repair welds should not exceed those given in Table 12 unless otherwise specified by the company.

Chemical composition should be used to determine the carbon equivalent of the base materials, to provide context for hardness measurements. Multiple thermal cycles from repair welding may widen the heat-affected zone and/or have adverse effects on the hardness and strength of the heat-affected zone.



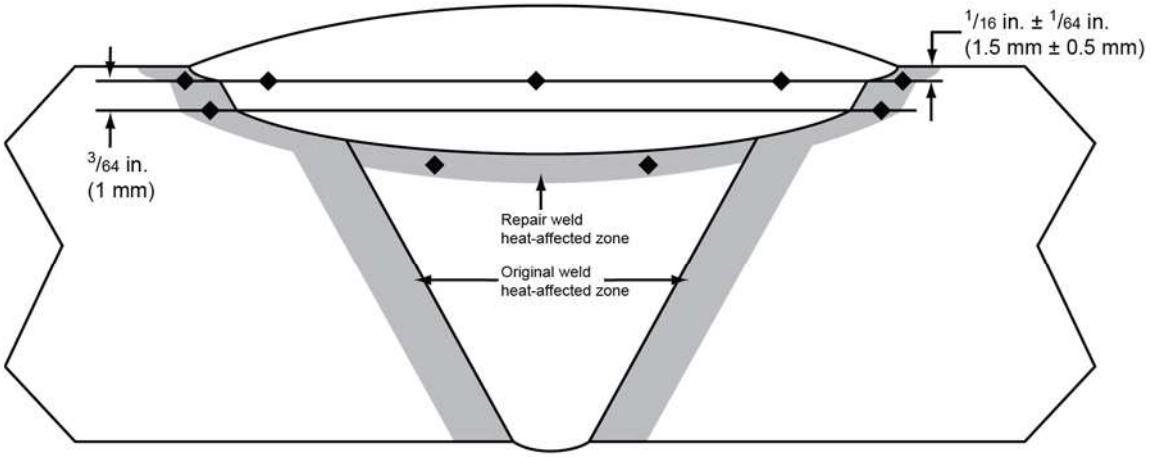
NOTE Heat-affected zone (HAZ) hardness impressions must be entirely within the HAZ and located as close as possible to the fusion boundary (between the weld metal and HAZ). The wall thickness of the specimen may prevent all the indents as shown from being made, particularly along the mid-point of the specimen.

Figure 22—Hardness Locations for Full-thickness Repair Procedure Qualification



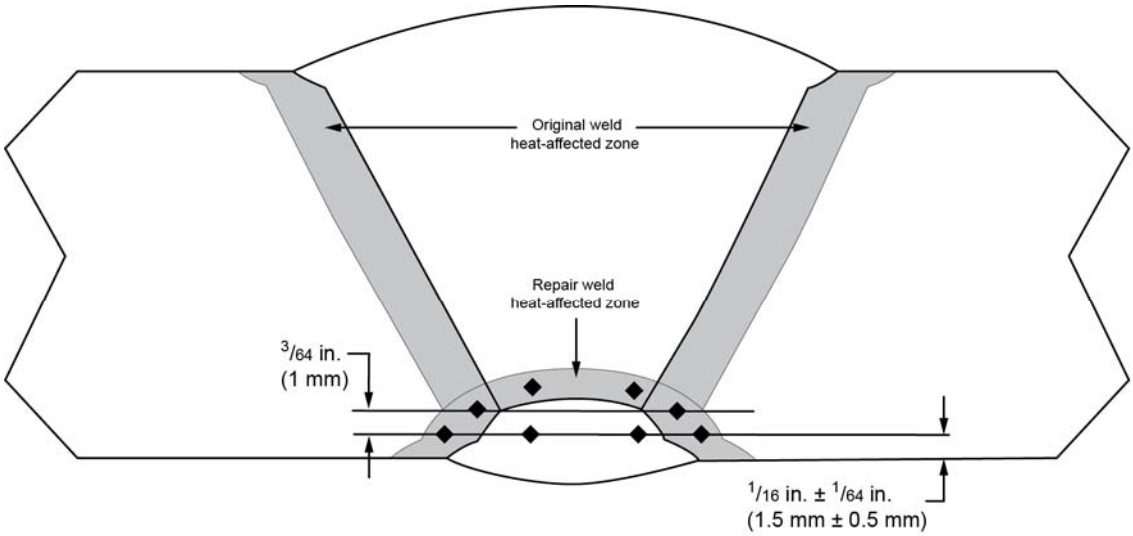
NOTE Heat-affected zone (HAZ) hardness impressions must be entirely within the HAZ and located as close as possible to the fusion boundary (between the weld metal and HAZ). The wall thickness of the specimen may prevent all the indents as shown from being made.

Figure 23—Hardness Locations for External Partial-thickness Repair Procedure Qualification at Weld



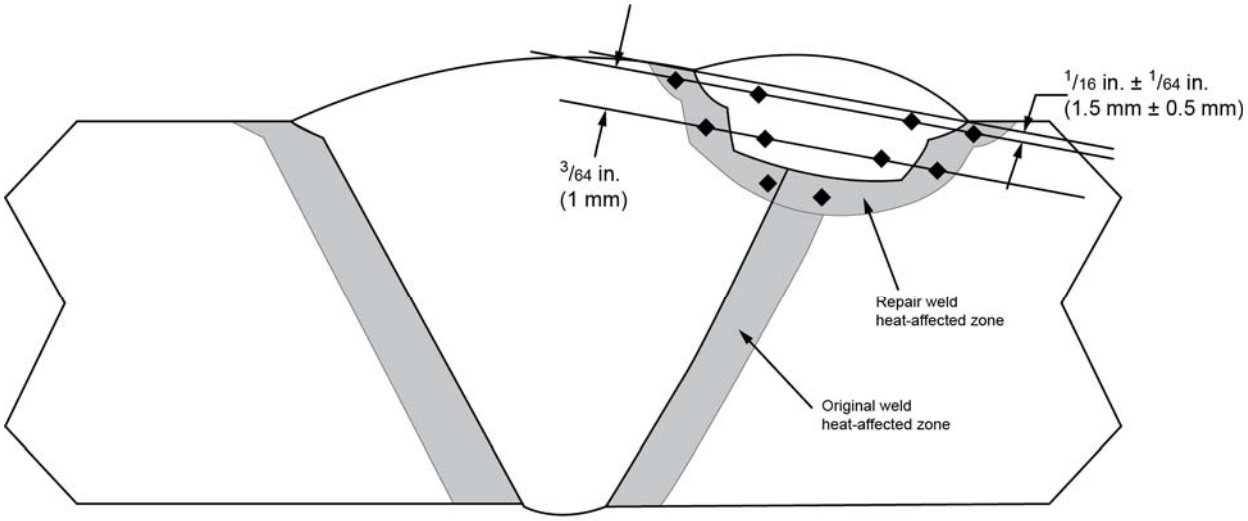
NOTE Heat-affected zone (HAZ) hardness impressions must be entirely within the HAZ and located as close as possible to the fusion boundary (between the weld metal and HAZ).

Figure 24—Hardness Locations for Cover Pass Repair Procedure at Weld Centerline



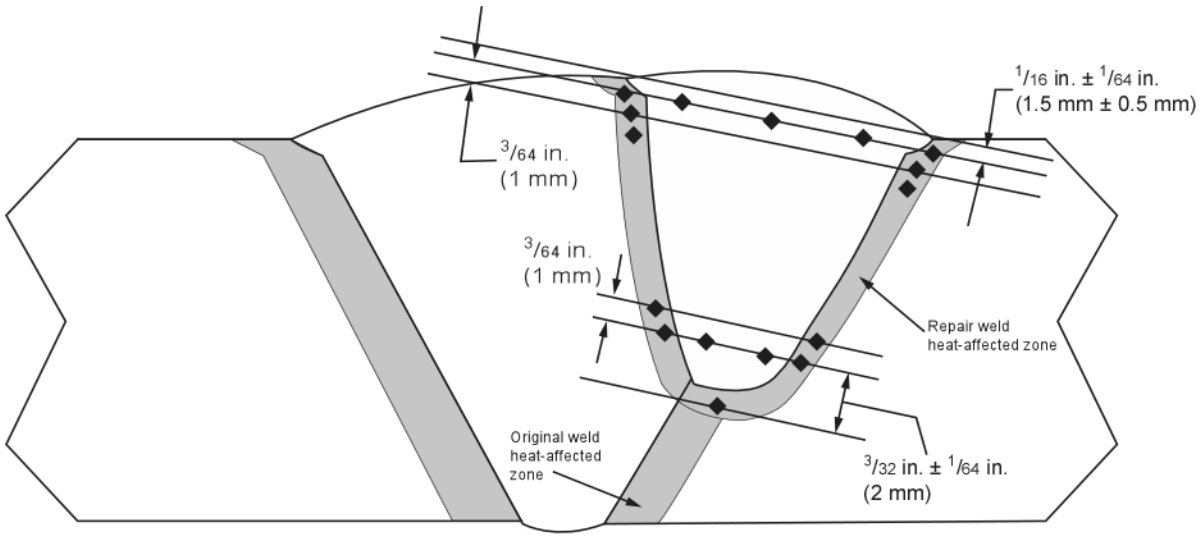
NOTE Heat-affected zone (HAZ) hardness impressions must be entirely within the HAZ and located as close as possible to the fusion boundary (between the weld metal and HAZ).

Figure 25—Hardness Location for Back Weld Repair or Internal Partial-Thickness Repair Procedure at Weld Centerline



NOTE Heat-affected zone (HAZ) hardness impressions must be entirely within the HAZ and located as close as possible to the fusion boundary (between the weld metal and HAZ).

Figure 26—Hardness Locations for Cover Pass Repair Procedure at Fusion Line



NOTE Heat-affected zone (HAZ) hardness impressions must be entirely within the HAZ and located as close as possible to the fusion boundary (between the weld metal and HAZ).

Figure 27—Hardness Locations for External Partial-Thickness Repair at Fusion Line

Table 12—Repair Weld Maximum Hardness Values, Non-Sour Service, HV10 [a]

Hardness Location	Weld Metal		Heat-affected Zone	
	Root and Mid-thickness	Cap	Root and Mid-thickness	Cap
Low-hydrogen welding process	275	275	350	350
Any welding process	275 [b]	275	275	325

NOTE 1 The company may specify other maximum hardness values.

NOTE 2 For sour service, see applicable governing standard or specification document.

[a] A lower load may be used for the narrow heat-affected zones in some welds made by mechanized or automatic processes.

[b] 300 HV10 when base metal thickness is 0.375 in. (9.5 mm) and above.

10.4 Repair Welder Qualification

10.4.1 General

When a repair procedure is required by 10.2, a qualified repair welder shall be required. A qualified repair welder shall be also required when making a full-thickness repair using the original production welding procedure. The repair welder and repair welding procedure may be qualified simultaneously, provided a tensile specimen is added (when required) per Table 11. The purpose of the repair welder qualification test is to determine the ability of welders to make sound repair welds. A single welder shall deposit the entire repair thickness for the qualification test weld; qualification may not be split between two or more welders. The welder shall be qualified per the requirements of this section.

The welder shall qualify by depositing a repair weld, following all details of a repair procedure, into a fully completed circumferential butt weld. The welder performing the qualification test shall not be required to weld the original weld joint that will be used during qualification. The repair welder shall prepare their own repair groove, in addition to completing the repair weld, in the position to be qualified (see 10.4.3.3). A single full-circumference test joint may be used to qualify more than one welder or a welder for more than one type of repair. The test joint can be repositioned to deposit the repair weld in the position designated by the company. The repair weld shall be deposited in the fixed position for each repair type to be qualified in the location(s) specified by the company, unless the repair weld will be rolled. The repair weld length shall be adequate for the number of specimens required by Table 14 and should be 8 in. (203 mm) minimum.

Details of the repair welder qualification shall be recorded and maintained in accordance with 6.8. In addition to the requirements of 6.8, the record shall include, at a minimum, documentation of the observed values (or actual) of welder essential variables as specified in 10.4.3. An example record of welder essential variables and other welding variables is shown in Table 13. A form should be developed to suit the needs of the individual company, and should be sufficiently detailed to demonstrate that the qualification test met the requirements of this standard. A welder may be required to requalify if a question arises regarding the welder's competence.

Table 13—Repair Welder Qualification Scope

Essential Variables Required to be Recorded for Welder Qualification	Actual Values used During Qualification	Qualification or Qualification Range Achieved
Welding process(es)		
Filler metal group(s)		
Repair type		
Thickness of weld metal deposited per filler group number		
Position of repair groove		
Direction of welding		

10.4.2 Testing of Repair Welders

For a repair welder qualification test weld, the repair weld shall meet the visual examination requirements of 6.4.

The total number of specimens and the test to which each shall be submitted are shown in Table 14. The destructive testing requirements shall follow 6.5.2 and 6.5.3 for nick break and bend tests, respectively, except that test specimens shall be cut from the joint at each individual repair area location for each type of repair. Excluding nick break specimens, the test specimens can be taken from the repair weld in any order; a specific sequence is not specified. A failed bend test specimen may be replaced in accordance with 6.5.3.

At the company's option, the qualification repair weld may be examined by radiography, or the ultrasonic testing method as used to inspect a production weld, using a qualified NDT procedure in lieu of destructive tests. Radiography shall meet the requirements of 9.3; ultrasonic testing shall meet the requirements of 9.6. Only the repair weld area shall be inspected.

A welder who fails to pass the repair welder qualification test(s) shall be permitted to retest as described in 6.7.

Table 14—Type and Number of Butt Weld Test Specimens per Repair Type for Repair Welder Qualification

Repair Type	Nick Break [a]	Root Bend	Face Bend	Side Bend	Total (Minimum)
Nominal Wall Thickness ≤ 0.500 in. (12.7 mm)					
Full-thickness	2	1	1	0	4
Internal partial-thickness	2	0	1 [b]	0	3
External partial-thickness	2	0	1	0	3
Cover pass	2	0	1	0	3
Back weld	2	0	1 [b]	0	3
Nominal Wall Thickness > 0.500 in. (12.7 mm)					
Full-thickness	2	0	0	2	4
Internal partial-thickness	2	0	0	1	3
External partial-thickness	2	0	0	1	3
Cover pass	2	0	0	1	3
Back weld	2	0	0	1	3

[a] One nick break specimen is taken at the transition between the repair weld end and original weld bead and the second nick break specimen located at the midpoint of the repair weld deposit.

[b] The weld face is located on the inside (concave side) of the pipe.

10.4.3 Qualification Limits

A repair welder who has successfully completed the qualification test described in 10.4.1 and 10.4.2 shall be qualified within the limits of the essential variables described in Table 15. Pipe diameter shall not be an essential variable for a repair welder. If any of the following essential variables are changed, the repair welder using a repair procedure shall be requalified.

Table 15—Essential Variables for Repair Welders

Welding Variable Subsection[a]	Change Requiring Requalification
10.4.3.1 Welding Process	a) A change from one repair welding process to another repair welding process. b) A change in the combination of repair welding processes, unless the welder has qualified on separate qualification tests, using each of the repair welding processes that are to be used for the combination of repair welding processes. c) When more than one process is used to complete the joint, a change of the welding process used for the pass types (i.e., root, fill, cap). However, the welder may make repair welds using only the process or processes used for fill and cap passes even if the test weld used a combination of processes, provided 10.4.3.5 is met. d) When the process used for fill passes in testing is used to make a complete repair weld, the process shall have been used for three or more passes in the testing. Processes used for less than three passes in testing shall not be used for more than two passes in a repair weld.
10.4.3.2 Deposit Thickness	a) The welder is qualified to weld a maximum deposited thickness of two times the deposited repair weld thickness in the repair welder qualification test. b) For the GMAW short circuiting mode (GMAW-S), the welder shall only use GMAW-S during repair welding for the same passes that they deposited GMAW-S in qualification testing.
10.4.3.3 Position [b]	a) Qualification on the top of the pipe (flat) only qualifies for that position. b) Qualification on the side of the pipe (vertical) qualifies to weld on the side and top of the pipe. c) Qualification in the horizontal position (pipe oriented in 2G) qualifies to weld horizontally and on the top of the pipe. d) Qualification in the 5G in the overhead position qualifies for all positions except for horizontal welding (pipe oriented in 2G). e) A qualification scheme using c) and d) qualifies the welder for all positions. f) Qualification in the 6G, in the overhead position, qualifies the welder for all positions. g) A change from rolled to fixed position. A welder who qualifies in the fixed position shall also be qualified to perform rolled repair welds within the essential variables qualified.
10.4.3.4 Direction	For fixed position welding, a change in the direction of welding from vertical up to vertical down or vice versa or a change from vertical progression, up or down, to horizontal progression or vice versa. The specified direction of vertical progression, up or down, is not intended to prevent welders from welding across the top dead center or bottom dead center of a pipe oriented in the horizontal position to avoid stacking starts and stops. A repair welder who successfully passes a qualification test in the 6G position, as per 10.4.3.3.f, shall also be qualified for the horizontal direction.
10.4.3.5 Filler Metal	a) For the root bead of a full-thickness repair, a change of filler metal group number. b) For all other weld passes, a change of filler metal classification from Group 1 or 2 to any other group or from any Group 3 through 8 to Group 1 or 2 (see Table 2). c) A change of filler metal classification not listed in Table 2 to any other filler metal classification or vice versa.
10.4.3.6 Repair Type [c,d,e]	a) A change from external partial-thickness to full-thickness, internal partial-thickness, or back weld. b) A change from internal partial-thickness to full-thickness. c) A change from back weld to any other repair type. d) A change from cover pass to any other repair type.

[a] The subsection numbers in this column are provided for referencing purposes.

[b] Definitions for welding positions can be found in AWS A3.0.

[c] A full-thickness repair qualification qualifies all other repair types.

[d] Repair types are independent of joint type (i.e., butt weld repair qualifications can be applied to fillet and branch joint designs); all tests shall be carried out on butt welds.

[e] See Table 16 for 10.4.3.6.

Table 16—Repair Welder Qualification Matrix

Repair Type Performed During Qualification	Repair Type Qualified				
	Full-Thickness	External Partial-Thickness	Internal Partial-Thickness	Cover Pass	Back Weld
Full-thickness	X	X	X	X	X
External partial-thickness		X		X	
Internal partial-thickness		X	X	X	X
Back weld					X
Cover pass				X	
NOTE Repair types are independent of joint type (i.e., butt weld repair qualifications can be applied to fillet and branch joint designs).					

10.5 Inspection of Repair Welding

Repair welding inspection shall be performed as specified by the company. Welding inspection personnel shall meet the requirements of 8.3.

Repairs shall be documented, and the documentation maintained by the company.

10.6 NDT and Weld Repair Acceptance Criteria

When weld metal is added to make the repair, all NDT methods required on the original weld shall also be used to inspect the repair weld. NDT of a repair weld shall include, at a minimum, the total repair area plus 2 in. (50 mm) on each side of the repair area. Repairs shall be considered acceptable when the repair area meets the standards of acceptability of Section 9 or the acceptance criteria specified by Annex A, Option 3.

Visual testing shall be considered adequate when the defect is rejected by visual means and repaired by grinding without the addition of weld metal.

When in-process NDT is required, the company shall define the acceptance criteria.

11 Procedures for Nondestructive Testing (NDT)

11.1 General

11.1.1 Radiographic Testing Methods

The requirements of 11.1 shall be applicable for producing radiographic image(s) on film, phosphor imaging plate (PIP), computed radiography (CR), or with digital radiography (DR) acquisition devices [e.g., DDA, LDA, CCD, FPD, CMOS (both static and in-motion)] through the use of X-rays or gamma rays. A detailed procedure for the production of radiographic image(s) shall be established and documented. Radiographic image(s) produced by the use of this procedure shall meet the requirements of the applicable subsection as it pertains to sensitivity, resolution, radiographic image quality, intensity, or density as applicable. The following criteria shall be used to evaluate radiographic image(s):

a) an acceptable radiographic image quality that is free from artifacts, fog, or other types of processing irregularities that could mask the image of actual imperfections;

b) IQIs—The type of material, ASTM or ISO identification, and the following type of IQI used shall appear clearly in the radiographic image:

   1) wire type: the essential wire across the area of interest; or

   2) hole type: the essential hole and IQI outline on at least three sides;

c) a satisfactory identification system;

d) an acceptable technique and setup;

e) compatibility with acceptance standards.

All requirements that refer to the quality of the resulting radiographic image(s) shall apply equally when using X-rays and gamma rays. The use of radiographic testing and the frequency of its use shall be at the option of the company. The company and the radiographic contractor should agree on the radiographic procedure or procedures to be used prior to the performance of production radiography. The company shall require the contractor to demonstrate and use procedures that produce acceptable radiographic image(s).

11.1.2 Details of Procedure

11.1.2.1 General

The details of each radiographic procedure shall be recorded and may include a sketch. A copy of the record shall be furnished to the company for its records.

At a minimum, each procedure shall include the details listed in 11.1.2.2, 11.1.2.3, or 11.1.2.4 as applicable.

11.1.2.2 Film Radiography

At a minimum, the procedure for film radiography shall include the following details:

a) Radiation source: the type of radiation source, the size of the effective source or focal spot, and the voltage rating of the X-ray equipment;

b) Intensifying screens: the type and placement of the screens and, if lead is used, their thickness;

c) Film: the film brand or type, or both, and the number of film in the holder or cassette. For multiple-film techniques, the way in which the film is to be viewed shall be specified;

d) Exposure geometry: whether single-wall exposure for single-wall viewing (SWE/SWV), double-wall exposure for single-wall viewing (DWE/SWV), or double-wall exposure for double-wall viewing (DWE/DWV); the distance from the source or focal spot to the film; the relative positions of the film, weld, source, IQIs, and interval or reference markers; and the number of exposures required for radiography of a complete weld;

e) Exposure conditions: whether milliampere or curie minutes, the X-ray voltage or the input voltage and amperage, and the exposure time;

f) Processing: whether automated or manual; the time and temperature range for development and the time for stop bath or rinsing, fixing, and washing; and drying details;

g) Materials: the type and thickness range of material for which the procedure is suitable;

h) IQIs: the type of material, ASTM or ISO identification, and the following type of IQI used shall appear clearly in the radiographic image:

1) wire type: the essential wire across the area of interest;

2) hole type: the essential hole and IQI outline on at least three sides.

11.1.2.3 Computed Radiography (CR)

At a minimum, the procedure for radiography using computed radiography (CR) imaging shall include the following details:

a) Radiation source: the type of radiation source, the size of the effective source or focal spot, and the voltage rating of the X-ray equipment;

b) Intensifying screens: The type and placement of the screens and, if lead is used, their thickness;

c) Phosphor imaging plate (PIP): the PIP brand and type;

d) Exposure geometry: whether single-wall exposure for single-wall viewing (SWE/SWV), double-wall exposure for single-wall viewing (DWE/SWV), or double-wall exposure for double-wall viewing (DWE/DWV); the distance from the source or focal spot to the PIP; the relative positions of the PIP, weld, source, IQIs, and interval or reference markers; and the number of exposures required for radiography of a complete weld;

e) Image acquisition system manufacturer and model;

f) Materials: the type and thickness range of material for which the procedure is suitable;

g) IQIs: the type of material, ASTM or ISO identification, and the following type of IQI used shall appear clearly in the radiographic image:

1) wire type: the essential wire across the area of interest;

2) hole type: the essential hole and IQI outline on at least three sides of the IQI are visible in the radiographic image;

h) Software: The version and revision number used for acquisition.

11.1.2.4 Digital Radiography (DR)

At a minimum, the procedure for radiography using digital radiography (DR) imaging shall include the following details.

a) Radiation source: the type of radiation source, the size of the effective source or focal spot, and the voltage rating of the X-ray equipment;

b) Radiation filters/masking: the type and placement of the filters/masking and their thickness;

c) Detector: the detector type, manufacturer, and model;

d) Exposure geometry: whether single-wall exposure for single-wall viewing (SWE/SWV), double-wall exposure for single-wall viewing (DWE/SWV), or double-wall exposure for double-wall viewing (DWE/DWV); the distance from the source or focal spot to the detector; the relative positions of the detector, weld, source, IQIs, and interval or reference markers; and the number of exposures required for radiography of a complete weld;

e) Image acquisition system manufacturer and model;

f) Materials: the type and thickness range of material for which the procedure is suitable;

g) IQIs: the type of material, ASTM or ISO identification, and the following type of IQI used shall appear clearly in the radiographic image:

   1) wire type: the essential wire across the area of interest;

   2) hole type: the essential hole and the IQI outline on at least three sides of the IQI are visible in the radiographic image;

h) Software: the version and revision number used for acquisition;

i) Image display and viewing requirements;

j) The detector and source alignment validation;

k) Exposure conditions: X-ray voltage or the input voltage and amperage range, the exposure time and number of integrations, frame averaging or frame rate as applicable.

11.1.2.4.1 Digital Radiography (DR) Calibration

Calibration of digital detectors shall be addressed by the procedure and shall be required for the following:

a) at the commencement of the qualification of each examination procedure;

b) a change in material type and thickness;

c) a change in quantity and/or energy of radiation (voltage, isotope);

d) a change in equipment used;

e) a temperature variance in accordance with the manufacturer's guidelines;

f) a change in technique parameters;

g) failure to achieve the image quality requirements.

11.1.2.4.2 In-Motion Digital Radiography (RTR)

When in-motion digital radiography is performed involving movement of the source and/or detector, the following shall apply:

a) The beam width shall be controlled by using a metal diaphragm, such as lead. The diaphragm for the energy selected shall have a half-value layer (HVL) thickness of at least 10.

   The beam width, as demonstrated in Figure 28, shall be determined per Equation (4):

$$w = \frac{c\left(F + a\right)}{b} + a \tag{4}$$

where

a = slit width in diaphragm in the direction of motion;

b = distance from source to the material/weld side of the diaphragm;

c = distance from material/weld side of the diaphragm to the source side of the material/weld surface;

F = source size: the maximum projected dimension of the radiating source (or focal spot) in the plane perpendicular to the distance $b + c$ from the material/weld being radiographed;

w = beam width at the source side of the material/weld measured in the direction of motion.

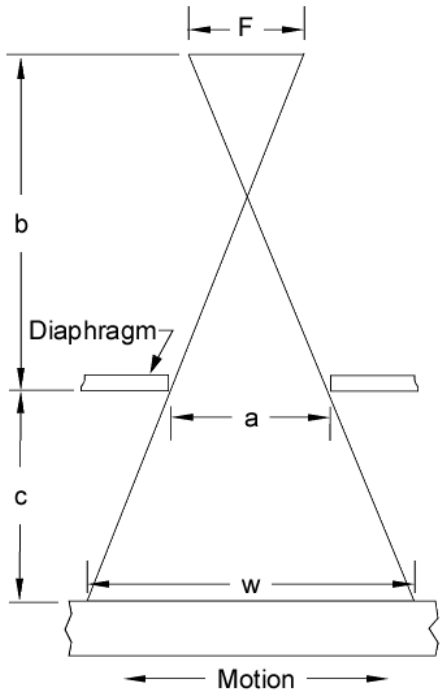


Figure 28—Calculation for Determining Beam Width

b) Alternatively, the detector's active area shall be limited so that the radiographic image produced meets the image quality requirements.

11.1.2.4.3 In-Motion Digital Radiography (RTR) Unsharpness

In-motion unsharpness or blur of the radiographic image shall be addressed by the procedure. The procedure shall clearly define the means of control and means of measuring total image unsharpness.

The procedure shall clearly identify the means for determining source-side geometric unsharpness and shall ensure that the source-side geometric unsharpness of the weld does not exceed 0.02 in. (0.5 mm) for material with a thickness of less than or equal to 2.00 in. (50.8 mm).

11.1.3 Exposure Geometry

11.1.3.1 Film and Computed Radiography (CR)

When a radiographic source is centered in the pipe for exposing a butt weld, one exposure shall be adequate for the radiographic inspection of the complete weld (SWE/SWV). When the radiographic source is outside but not more than ½ in. (13 mm) from the weld surface, at least three exposures separated by 120° shall be made for the radiographic inspection of a complete weld (DWE/SWV). When the radiographic source is outside and more than ½ in. (13 mm) from the weld surface, at least four exposures separated by 90° shall be made for the radiographic inspection of a complete weld (DWE/SWV).

When the outside diameter of the piping containing the weld is 3.500 in. (88.9 mm) or less is to be inspected with DWE/SWV, a minimum of four exposures separated by 90° shall be required to minimize the distortion of the radiographic image(s).

Alternatively, when the outside diameter of the piping containing the weld is 3.500 in. (88.9 mm) or less, a DWE/DWV procedure may be used.

When a DWE/DWV procedure is used and the radiation beam is offset so that the source-side and film or PIP-side portions of the weld do not overlap in the areas of the radiograph being evaluated, at least two exposures separated by 90° shall be made for the radiographic inspection of a complete weld. When the source-side and film or PIP-side portions of the weld are superimposed, at least three exposures separated by 60° shall be made for the radiographic inspection of a complete weld.

The minimum distance between the source or focal spot and the source side of the object being radiographed shall be determined by Equation (5) (using constant units of measurement):

$$D = \frac{St}{k} \tag{5}$$

where

D is the minimum distance, in in. (mm), between the source or focal spot and the source side of the object being radiographed;

S is the size, in in. (mm), of the effective source or focal spot;

t is the thickness of the weld, in in. (mm), including reinforcement, plus the distance between the film or PIP side of the weld and the film or PIP;

k is the geometric unsharpness factor.

When t is determined for SWE/SWV and DWE/SWV procedures, the thickness of the single wall and its weld reinforcement shall be used. When t is determined for DWE/DWV procedures, the outside diameter of the weld (that is, the outside diameter of the pipe plus twice the average height of the weld crown) shall be used. k is defined as 0.02 in. (0.5 mm) for material with a thickness of less than or equal to 2.000 in. (50.8 mm).

11.1.3.2 Digital Radiography (DR)

For static (fixed position) detector and source set-ups, the requirements of 11.1.3.1 shall apply. For in-motion imaging, the exposure geometry shall be evaluated at the maximum scanning speed to be used during the radiographic testing of the complete weld. Acquired scan lengths shall be verified to ensure full coverage of the butt weld has been obtained.

11.1.4 Type of Image Quality Indicator (IQI)

The image quality indicator (IQI) shall conform to the requirements of ASTM E747, ISO 19232-1 wire type, or ASTM E1025 hole-type IQI. The company shall define which type of IQI (ASTM or ISO) is to be used. The IQI shall be made of a material that is radiographically similar to the material being welded.

11.1.5 Selection of Image Quality Indicator (IQI)

The IQI shall consist of either a series of six wires for ASTM E747 wire type or a series of seven wires for ISO 19232-1 wire type IQI. Table 17 for ASTM E 747 wire type IQI, Table 18 for ISO 19232-1 wire type IQI, and Table 19 for ASTM E1025 hole-type IQI outline the required IQI identification, essential wire, or essential hole required based on material thickness of the thinner joining material plus applicable reinforcement.

For purposes of IQI selection, the thickness of the weld shall mean the thinner of the nominal wall thicknesses being joined plus the weld reinforcement (internal plus external combined). The IQI type of material, ASTM or ISO identification, and the following shall appear clearly in the radiographic image:

1) Wire type: the essential wire across the area of interest;

2) Hole type: the essential hole and the outline of at least three sides of the IQI are visible in the radiographic image.

Table 17—ASTM E747 Wire Type IQI Selection

Weld Thickness		Essential Wire Diameter		ASTM Set Letter
in.	mm	in.	mm	
0 to 0.250	0 to 6.4	0.008	0.20	A
> 0.250 to 0.375	> 6.4 to 9.5	0.010	0.25	A or B
> 0.375 to 0.500	> 9.5 to 12.7	0.013	0.33	B
> 0.500 to 0.750	> 12.7 to 19.1	0.016	0.41	B
> 0.750 to 1.000	> 19.1 to 25.4	0.020	0.51	B
> 1.000 to 2.000	> 25.4 to 50.8	0.025	0.64	B

Table 18—ISO Wire Type IQI Selection

Weld Thickness		Essential Wire Diameter		Wire Identity
in.	mm	in.	mm	
0 to 0.250	0 to 6.4	0.008	0.20	13
> 0.250 to 0.375	> 6.4 to 9.5	0.010	0.25	12
> 0.375 to 0.500	> 9.5 to 12.7	0.013	0.33	11
> 0.500 to 0.750	> 12.7 to 19.1	0.016	0.41	10
> 0.750 to 1.000	> 19.1 to 25.4	0.020	0.51	9
> 1.000 to 2.000	> 25.4 to 50.8	0.025	0.64	8

Table 19—ASTM E1025 Hole Type IQI Selection

Weld Thickness		Maximum IQI Thickness		Image Quality Indicator	
in.	mm	in.	mm	Identifying Number	Essential Hole
0 to 0.250	0 to 6.4	0.0125	0.317	12	2T
> 0.250 to 0.375	> 6.4 to 9.5	0.015	0.381	15	2T
> 0.375 to 0.500	> 9.5 to 12.7	0.0175	0.444	17	2T
> 0.500 to 0.750	> 12.7 to 19.1	0.020	0.508	20	2T
> 0.750 to 1.000	> 19.1 to 25.4	0.025	0.635	25	2T
> 1.000 to 2.000	> 25.4 to 50.8	0.030	0.762	30	2T

11.1.6 Placement of Image Quality Indicators (IQI)

The IQIs shall be placed as follows:

a) When a complete weld is radiographed in a single exposure using a source inside the piping (SWE/SWV), a minimum of four IQIs shall be used. Wire type shall be placed across the weld or hole type shall be placed adjacent to the weld on the film, PIP, or detector side. The IQIs shall be spaced approximately equally around the circumference of the pipe.

b) For the DWE/DWV procedure, one IQI shall be placed on the source side of the pipe and across the weld for wire type, or adjacent to the weld for hole type.

c) For the DWE/SWV or SWE/SWV procedures requiring multiple exposures for complete inspection of the weld, and where the length of film, PIP, or detector image to be interpreted is greater than 5 in. (130 mm), two IQIs placed across the weld for wire type or adjacent to the weld for hole type, and located on the film, PIP, or detector side, shall be used. One IQI shall be within 1 in. (25 mm) of the end of the film, PIP, or detector image length to be interpreted and the other IQI shall be at the center of the film, PIP, detector image for wire type or adjacent to the weld for hole type. When the film, PIP, or detector image length to be interpreted is 5 in. (130 mm) or less, one IQI shall be placed on the film, PIP, or detector side, across the weld for wire type or adjacent to the weld for hole type, and located at the center of the image length to be interpreted.

d) When multiple film or PIP cassettes are used in a single exposure, the requirements of 11.1.6 shall apply for each individual film or PIP length.

e) When a repaired weld is radiographed, it shall conform to the requirements of 11.1.6 for IQI placement.

When it is not practical to place an IQI on the weld due to weld configuration or size, the IQI may be placed on a separate block.

Separate blocks shall be made of the same or radiographically similar material, and may be used to facilitate IQI positioning. The thickness of the separate block material should be the same as the thickness of the weld and shall not be closer than the source side of the weld being inspected.

Alternatively, for DR/RTR:

— The IQI may be placed above the surface of the pipe or held in position between the surface of the pipe and the imager by a fixture attached to the imager or scanning device. Acceptability of such IQI placement shall be demonstrated during procedure qualification.

— When in-motion digital radiography (RTR) is used with an exposure of DWE/SWV and performed in one continuous exposure, at least four IQIs shall be equally spaced on the detector side of the weld.

11.1.7 Shims

For hole-type IQIs, shims of material that is radiographically similar to that of the pipe and equivalent in thickness to the average weld reinforcement shall be placed under the IQI. The shim dimensions shall exceed the IQI dimensions such that the outline of at least three sides of the IQI are visible in the radiographic image.

11.1.8 Film Densitometer Calibration

Densitometer calibrations shall be performed annually and documented with a calibrated step wedge that meets the manufacturer’s requirements.

11.1.9 Production Radiography

Only Level II or III radiographers shall interpret the radiographic image(s) of production welds. Radiographers shall report to the company all defects observed in the radiographic image(s) unless the company requires that all imperfections observed be reported. The radiographer shall indicate whether the weld meets the requirements of Section 9. The company shall determine the final disposition of the weld.

11.1.10 Identification of Radiographic Image(s)

Image(s) shall be clearly identified by the use of lead numbers, lead letters, markers, or other identification so that the weld and any imperfections in it can be quickly and accurately located.

NOTE The company may specify the identification procedure to be used.

Whenever more than one image is used to inspect a weld, identification markers shall appear on each image, and adjacent image(s) shall overlap. The last reference marker on each end of the image shall appear on the appropriate adjacent image(s) in a way that establishes that no part of the weld has been omitted.

At a minimum, the weld identification and location markers shall appear as part of the radiographic image captured during exposure. All other documentation can be attached to the image as a text box, overlay, or flashed image.

Any edits or corrections needed to the identification(s) of a radiographic image shall have prior documented approval from the company before edits or corrections are to be made.

11.1.11 Storage of Film and Other Imaging Media

11.1.11.1 Film

All unexposed films shall be stored in a clean, dry place where the conditions will not detrimentally affect the emulsion. If any question arises about the condition of the unexposed film, sheets from the front and back of each package or a length of film equal to the circumference of each original roll shall be processed in the normal manner without exposure to light or radiation. If the processed film shows fog, the entire box or roll from which the test film was removed shall be discarded, unless additional tests prove that the remaining film in the box or roll is free from pre-exposure fog exceeding 0.30 H&D transmitted density.

NOTE H&D refers to the Hurter-Driffield method of defining quantitative blackening of the film [8].

11.1.11.2 Other Imaging Media

Imaging media other than film shall be stored in strict accordance with the manufacturer's recommendations.

11.1.12 Film Requirements

11.1.12.1 General

Except for small localized areas caused by irregular weld configurations, the transmitted H&D density in the area of interest shall not be less than 1.8 nor greater than 4.0. Transmitted H&D densities through small localized areas may exceed these limits; however, minimum densities shall not be less than 1.5 and maximum densities shall not exceed 4.2.

11.1.12.2 Film Viewing Equipment

The viewing equipment (illuminator) shall be of the variable high-intensity type and shall be capable of viewing film densities within the range specified in 11.1.12.1. It shall be equipped to prevent light coming from around the outer edge of the radiograph or through low-density portions of the radiograph from interfering with interpretations.

11.1.12.3 Film Viewing Facilities

Viewing facilities shall provide subdued background lighting of an intensity that will not cause troublesome reflections, shadows, or glare on the radiograph.

[8] Ferdinand Hurter and Vero Charles Driffield, "Photochemical Investigations and a New Method of Determination of the Sensitiveness of Photographic Plates," J. Soc. Chem. Ind., May 31, 1890.

11.1.12.4 Film Processing

When requested by the company, film shall be processed, handled, and stored so that the radiographic image(s) are interpretable for at least three years after they are produced. The image processing area and all accessories shall be kept clean at all times.

11.1.12.5 Film Artifacts

The film shall be free of artifacts within the area of interest that could mask the image of actual imperfections.

11.1.12.6 Radiographic Film Review Form

The radiographer shall prepare a radiograph review form. At a minimum, the information shall be provided from 11.1.2.2 in addition to the requirements herein:

a) company, customer, or manufacturer;

b) contract or purchase order number that ties to the project;

c) project or line number;

d) a listing of material(s) or weld(s);

e) evaluation and disposition of the material(s) or weld(s) examined;

f) number of exposures for each weld;

g) name, certification ,and signature of the radiographer/interpreter;

h) date of examination;

i) procedure number and revision of that procedure;

j) acceptance criteria used for acceptance of 11.1.12.6.e.

11.1.13 Computed Radiography (CR) Requirements

11.1.13.1 General

In addition to the applicable requirements of 11.1.1 and 11.1.2, the requirements of this subsection shall apply when using phosphor imaging plates (PIP) is requested.

11.1.13.2 Image Intensity

Except for small localized areas caused by irregular weld configurations, the image intensity within the area of interest of an image shall not be less than 45 % of the system's bit depth capability (e.g., a 16-bit system has 65,536 shades of gray; therefore, no intensity shall be less than an intensity of 29,491.). The digital image shall not exceed the system's upper intensity limit (e.g., image saturation).

The image intensity throughout the area of interest shall be no less than 5 % brighter than the intensity adjacent to the essential wire or essential hole.

Alternatively, gray scales below 45 % of the system's bit depth can be utilized, provided a procedure demonstration is performed and documented for every diameter, thickness, and grade of material being inspected.

11.1.13.3 Image Processing

When requested by the company, radiographic image(s) shall be processed, handled, and stored so that the radiographic image(s) are interpretable for at least three years after they are produced. The image processing area and all accessories shall be kept clean at all times.

11.1.13.4 Dimensional Measurement

Calibration of the systems software measuring function shall be performed prior to interpretation. A verified scanned pixel size of the image is the preferred method.

Alternatively:

a) a known dimensional comparator shall be placed in direct contact with the cassette prior to exposure; or

b) a known dimensional comparator shall be inscribed on the imaging plate prior to processing; or

c) a known comparator scale shall be placed on the imaging plate prior to processing.

11.1.13.5 Image Artifacts

The radiographic image shall be free of artifacts within the area of interest that could mask the image of actual imperfections.

11.1.13.6 Image Evaluation

Prior to interpretation, the range of contrast and brightness values that demonstrate the required IQI sensitivity shall be determined. Final radiographic interpretation shall be performed on the data within this IQI sensitivity range.

The digital image may be viewed and evaluated in a negative or positive image format; however, the area of interest and IQI shall be of the same format.

Magnification may be used in the evaluation of the digital image and shall be agreed upon between the company and radiographic contractor.

11.1.13.7 Radiographic Review Form

The radiographer shall prepare a radiographic review form. At a minimum, the information shall be provided from 11.1.2.3 above in addition to the requirements herein:

a) company, customer, or manufacturer;

b) contract or purchase order number that ties to the project;

c) project or line number;

d) a listing of material(s) or weld(s);

e) evaluation and disposition of the material(s) or weld(s) examined;

f) number of exposures for each weld;

g) name, certification, and signature of the radiographer/interpreter;

h) date of examination;

i) procedure number and revision of that procedure;

j) acceptance criteria used for acceptance of item e).

11.1.14 Digital Radiography Requirements (DR/RTR)

11.1.14.1 General

In addition to the applicable requirements of 11.1.1 and 11.1.2, the requirements of this subsection shall apply when using digital radiography acquisition devices is requested

11.1.14.2 Image Intensity

Except for small localized areas caused by irregular weld configurations, the pixel intensities within the area of interest of an image shall be not less than 15 percent of the system's bit depth capability (e.g., a 16-bit system has 65,536 shades of gray potential; therefore, no intensity shall be less than an intensity of 9,831). The image pixel intensities within the area of interest shall also not exceed the system's upper grayscale limit (i.e., image saturation).

Alternatively, grayscales below 15 percent of the system's bit depth can be utilized, provided a procedure demonstration is performed and documented for every diameter, thickness, and grade of material being inspected.

11.1.14.3 Image Processing

When requested by the company, radiographic image(s) shall be processed, handled, and stored so that the radiographic image(s) are interpretable for at least three years after they are produced.

11.1.14.4 Dimensional Measurement

One of the following dimensional measurement techniques shall be performed to ensure the radiographic image is calibrated prior to interpretation.

a) The measurement scale tool shall be based upon a known dimensional comparator that is placed on or adjacent to the detector side of the weld near the area of interest during exposure.

b) Dimensional measurements shall be confirmed by verifying the measurement between two known reference points at the beginning and end of the radiographic image (0 – 0, 0 – A, etc.).

11.1.14.5 Image Artifacts

The radiographic image shall be free of artifacts within the area of interest that could mask the image of actual imperfections.

11.1.14.6 Image Evaluation

Prior to interpretation, the range of contrast and brightness values that demonstrate the required IQI sensitivity shall be determined. Final radiographic interpretation shall be performed on the data within this IQI sensitivity range.

The digital image may be viewed and evaluated in a negative or positive image format; however, the area of interest and IQI shall be of the same format.

Magnification may be used in the evaluation of the digital image and shall be agreed upon between the company and radiographic contractor.

11.1.14.7 Radiographic Review Form

The radiographer shall prepare a radiograph review form. At a minimum, the information shall be provided from 11.1.2.4 in addition to the requirements herein:

a) company, customer, or manufacturer;

b) contract or purchase order number that ties to the project;

c) project or line number;

d) a listing of material(s) or weld(s);

e) evaluation and disposition of the material(s) or weld(s) examined;

f) number of exposures for each weld;

g) name, certification, and signature of the radiographer/interpreter;

h) date of examination;

i) procedure number and revision of that procedure;

j) acceptance criteria used for acceptance of item e).

11.2 Magnetic Particle Testing Method

When magnetic particle testing is specified by the company, a detailed written procedure for magnetic particle testing shall be established that meets the requirements of ASTM E709. The company and the NDT contractor should agree on the magnetic particle testing procedure or procedures prior to the performance of production testing.

The company shall require the contractor to demonstrate that the proposed procedures will produce acceptable results, and shall require the contractor to use such procedures for production testing.

11.3 Liquid Penetrant Testing Method

When liquid penetrant testing is specified by the company, a detailed written procedure for liquid penetrant testing shall be established that meets the requirements of ASTM E165. The company and the NDT contractor should agree on the liquid penetrant testing procedure or procedures prior to the performance of production testing.

The company shall require the contractor to demonstrate that the proposed procedures will produce acceptable results and shall require the contractor to use such procedures for production testing.

11.4 Ultrasonic Testing Methods

11.4.1 General

When ultrasonic testing (UT) is specified by the company, the requirements of this section shall apply for both 9.6 (workmanship) or Annex A. The use of ultrasonic testing and the scope of its use shall be at the option of the company. The company shall require the ultrasonic system to be qualified and then demonstrated by the ultrasonic contractor. Detailed procedures for the use of the individual ultrasonic techniques (manual and automated) shall be established to cover the entire volume of the weld, including the heat-affected zone.

The qualification shall define the operational boundaries, proposed inspection (sizing) error, detectability, repeatability, reproducibility, and reliability of the UT system. Within the qualification data set, the worst cases of oversizing and undersizing shall be evaluated by the company. The methodology for the determination of the proposed inspection error shall be defined by the contractor and approved by the company.

The company shall require the ultrasonic contractor to demonstrate the UT procedure. The scope of the procedure demonstration (see 11.4.3) required to address project-specific variables shall be approved by the company.

The demonstration shall confirm the qualification results (including proposed inspection error) and that the proposed production procedure(s) produces acceptable and accurate results. In the event that the qualification results are not confirmed, the procedure shall not be approved for use by company. The company and the ultrasonic contractor shall agree and approve the ultrasonic procedures prior to ultrasonic testing of project welds in accordance with the requirements in this section.

Inside diameter and outside diameter pipe surfaces shall be suitable for ultrasonic testing (i.e., parallelism, surface roughness, uncoated, etc.). For new construction projects, the coating cutback (bare pipe length) at pipe ends necessary for ultrasonic scanning shall be specified. Pipe seam weld reinforcement (internal and external) shall be removed so that the surface of the pipe is continuous across the seam for the distance necessary and suitable for ultrasonic testing.

11.4.2 Ultrasonic Testing Personnel Requirements

An NDT Level III in the ultrasonic method shall develop the application technique and prepare and approve the testing procedure. Only NDT Ultrasonic Level II or III certified personnel shall calibrate equipment, perform the test, and interpret the test results per the acceptance/rejection criteria. Personnel used to perform ancillary activities (e.g., pipe scribing, band setting, scanner placement) related to AUT of the weld shall be trained and supervised by personnel certified in accordance with the NDT contractor's ASNT SNT-TC-1A written practice.

The ultrasonic testing personnel shall perform examinations in accordance with qualified and approved procedures (see 11.4.3). Personnel responsible for testing shall be capable of determining the acceptability of circumferential butt welds in accordance with the company approved accept/rejection criteria. The company shall approve project personnel. The company has the right, at any time, to require personnel to demonstrate their capabilities to perform to the requirements of the qualified procedure.

11.4.3 Demonstration and Acceptance of Ultrasonic Procedure

11.4.3.1 Procedure Demonstration Process

The demonstration and application of the ultrasonic procedure(s) and ultrasonic system(s) shall be performed. Project variables, including acoustic properties, diameter, wall thickness, bevel design, welding process, and repair welds, shall be considered prior to defining the scope of the procedure demonstration process. The performance demonstration process shall be documented.

The demonstration process shall be as follows:

a) Weld map(s) (applicable only to seeded defect welds) or as-built documentation depicting intended locations of the items below shall be prepared and submitted to the company prior to demonstration.

b) Weld(s) containing imperfections and defects shall be prepared from actual production pipe material utilizing the welding procedure specification approved by the company for demonstration activity. Weld development, practice, or welder qualification welds may be used if suitable imperfections and defects are present and acceptable to the company. The welds shall include:

    1) imperfections and defects inherent to the welding process;

2) a distribution of surface (ID and OD) as well as buried imperfections and defects;

3) multiple imperfections and defects aligned at the same circumferential location.

c) Radiographs in accordance with 11.1 or governing company specification shall be made of the welds and the results documented.

d) The UT procedure(s) shall be applied within the detailed temperature ranges, and the results shall be documented.

e) The AUT system shall demonstrate calibration consistency by positioning the calibration block in the 12 o'clock, 3 o'clock, and 6 o'clock positions.

f) The band placement offset defined in the procedure shall be demonstrated and documented.

g) A comparison of results between NDT methods shall be documented.

h) Differences in detectability and resolution between the ultrasonic and radiographic methods shall be noted.

i) Destructive testing, i.e., macrosectioning, shall be performed to confirm the sizing results. The location and number of destructive tests shall be defined by the company.

NOTE Use of alternative non-destructive testing in lieu of destructive testing of the weld sample may be used if qualified and approved by the company.

11.4.3.2 Procedure Demonstration Report

A procedure demonstration report shall document the results and be submitted to the company for approval prior to ultrasonic testing of project welds. The demonstration report shall include the following:

a) scope of the procedure demonstration process report;

b) WPS used for demonstration activity;

c) weld map(s) (applicable only to seeded defect welds);

d) RT report(s);

e) UT report(s) (manual UT and AUT);

f) destructive testing photomacrograph and report;

g) comparison report including UT (manual UT and AUT), RT, and destructive testing results;

h) technical summary of results;

i) justification of the inspection error;

j) any other requirements defined by the company.

11.4.3.3 Acceptance of Ultrasonic Testing Procedure

Acceptance of the UT procedure(s) for production weld testing shall be based on the capability of the UT operator/method/technique/system to:

a) circumferentially locate;

b) size for length;

c) size for height;

d) determine depth from OD surface; and

e) axially (weld cross-section) locate required imperfections/defects in the test samples.

In addition, the procedure shall accurately determine the acceptability of welds in accordance with the criteria listed in 9.6 and/or Annex A as defined by the company.

11.4.4 Parent Material Ultrasonic Testing

The company shall ensure a minimum length of 4 in. (101.6 mm) at each pipe end shall be free of any full or partial beam reflectors that could influence production weld inspection.

Welds completed without the use of factory ends shall require parent material inspection. All interfering partial and full beam reflectors shall be recorded on the examination report and the company shall be notified. Sensitivity applied for parent material inspection shall be defined in the ultrasonic testing procedure (11.4.6 or 11.4.7, as applicable) and approved by the company.

11.4.5 Production Ultrasonic Testing

Ultrasonic testing personnel shall report to the company all defects unless the company requires that all observed (evaluation level and above) indications and imperfections be reported. The company shall determine the final disposition of the weld.

11.4.6 Manual Ultrasonic Testing (MUT)

11.4.6.1 General

Manual ultrasonic testing (MUT) procedures shall include techniques for all ultrasonic applications for which the company defines ultrasonic inspection (i.e., wall thickness measurement, parent material inspection, production weld inspection, repair weld inspection). The company shall approve all manual ultrasonic testing procedures prior to use for project inspection.

11.4.6.2 Procedure Requirements

At a minimum, the procedure for manual ultrasonic testing shall include the following specific application details:

a) type of material or welds to be tested, joint preparation dimensions, and welding processes;

b) material type (i.e., size, grade, thickness, process of manufacturing per API 5L);

c) scanning surface preparation/condition;

d) stage at which the examination is to be performed;

e) ultrasonic instrument;

f) couplant.

g) testing technique:

— description of technique to be applied, including drawings and weld coverage;

- angle(s) inclusive of horizontal and vertical beam profiles;
- frequencies (MHz);
- temperatures and ranges;
- scanning patterns and speeds;
- reference datum and location markers (i.e., root face and circumferential location).

h) reference standards: detailed sketches showing plan view and cross-section view dimensions of production material reference standard blocks and all reference reflectors.

i) calibration requirements:

- the interval at which calibration of the instrument is required;
- the sequence of startup prior to inspecting welds;
- all calibration standards to be used;
- the reference sensitivity reflectors to be used;
- the reference sensitivity level settings;
- the requirements for verification of calibration settings;

j) scanning level: the sensitivity setting in dB to be added to the reference sensitivity for scanning;

k) evaluation level: the level or height of echoes detected during scanning at which further evaluation is required, and any sensitivity adjustment to be made before evaluating for acceptance or rejection;

l) imperfection sizing methodology;

m) record of results: type of record (e.g., sketch, image, scan, etc.);

n) reporting requirements:

- indications to be reported;
- weld status (accept/reject);
- defect type;
- defect height;
- defect length;
- defect locations (circumferential, radial, axial position);
- weld repair or cutout;
- final disposition of the weld.

o) ultrasonic examination report: an example of the examination report.

11.4.6.3 Manual UT Used with Automated UT

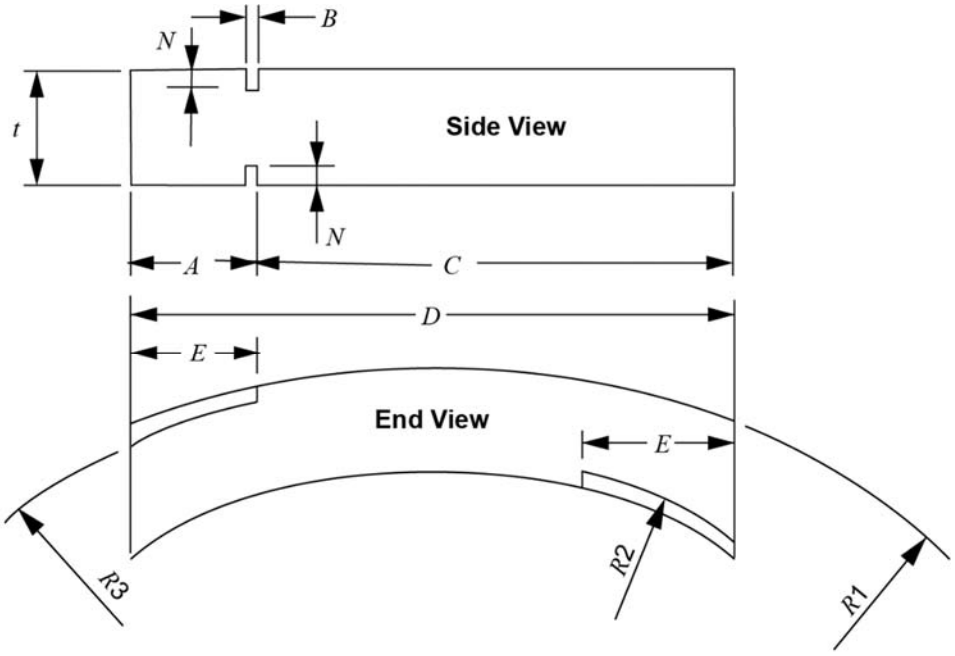
When MUT is applied in conjunction with AUT (i.e., loss of acoustic coupling, imperfection verification, repair weld inspection), the contractor shall ensure that the two techniques are equivalent in detectability. The MUT procedure shall define the process to be used to demonstrate the detectability between the AUT production weld testing technique and the MUT technique.

11.4.6.4 Reference Standards

Specific reference standards shall be designed for the purpose of manual ultrasonic testing. At a minimum, reference standards shall include inside diameter and outside diameter notches and may include side-drilled holes, flat bottom holes, or other reflectors proposed by the ultrasonic contractor and approved by the company. An example of a manual ultrasonic reference standard is included in Figure 29.

The reference standard shall also be used to determine the actual sound beam velocity, refracted angle, and sound path distance in the pipe material to be inspected. Unknown velocity and refracted angle shall be determined when welds in pipe of different chemistry specifications, wall thickness, diameter, or from more than one pipe and rolling or piercing manufacturer are to be inspected. This may be accomplished by using two probes of the same nominal angle and frequency with the probes directed toward one another (see Figure 30 and Figure 31). When a difference exceeding company-defined limits for velocity, angle, or sound path distance are reported, another reference standard shall be made from the different pipe material.

Prior to use, the reference standard shall be verified. The verification shall include mechanical and manual ultrasonic checks defined in a procedure approved by the company. These checks shall be performed and documented to ensure the reference standard’s suitability for use.



Dimensions

t	Specified pipe wall thickness
N	Notch depth = 10 % t ± 10 % of notch depth
A	2 in. (50 mm) minimum
B	0.125 in. (3.2 mm) maximum notch width
C	11.35t + 2 in. (50 mm) minimum length
D	3.1 in. (80 mm) minimum width
E	1 in. (25 mm) minimum notch length
$R1$	Outside radius of pipe
$R2$	Radius of inside notch = $R1 - 0.9t$
$R3$	Radius of outside diameter notch at depth = $R1 - 0.1t$

Figure 29—Example of Reference Standard for Manual Ultrasonic Testing

11.4.6.5 Establishing Distance, Refracted Angle, and Velocity

The procedure shall define the technique the ultrasonic contractor shall use for the determination of distance, refracted angle, and velocity.

Figure 30 defines an example of a technique to determine distance, refracted angle and velocity.

Position the transducer in line with the outside notch at double the distance used to peak up the inside notch (Position B). Verify that the outside notch echo peak is at or near zero depth reading. This will establish that refracted angle and velocity settings are sufficiently accurate.

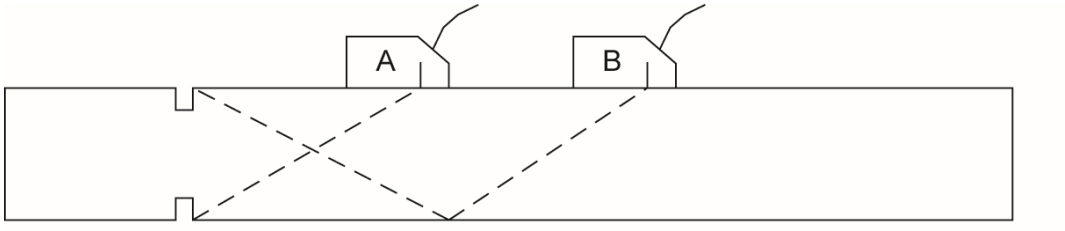


Figure 30—Example: Establishing Distance, Refracted Angle, and Velocity

11.4.6.6 Attenuation and Transfer Procedure

The procedure shall define the technique the ultrasonic contractor shall use for the attenuation and transfer procedure.

Figure 31 defines an example of a technique to determine attenuation and transfer measurements.

Using two transducers of equal angle and frequency, one transmitting and the other receiving, maximize (peak up) the echo received. Measure the surface distance between the transducer exit points. Half the surface distance divided by measured wall thickness equals the refracted angle tangent. Without changing instrument settings, repeat this process on pipe with unknown velocity, refracted angle, and attenuation to determine any differences.

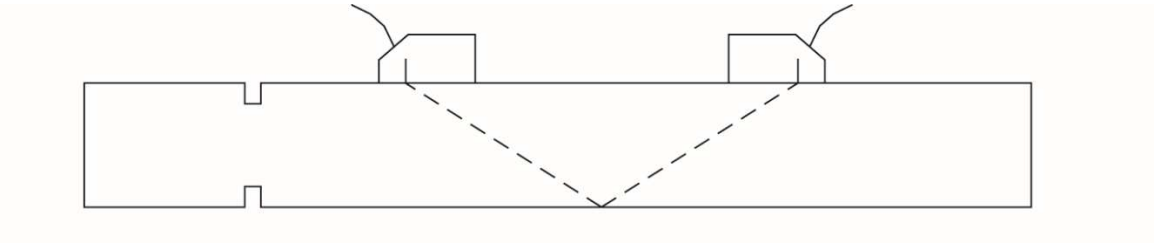


Figure 31—Example: Attenuation and Transfer Procedure

11.4.6.7 Calibration, Scanning, and Evaluation Level

Manual ultrasonic weld testing systems shall be calibrated as defined in the procedure. The minimum calibration requirements are as follows:

a) Unless alternate reflectors are specified in the MUT procedure, an N10 notch shall be used.

b) 80 % full screen height shall be used to establish the baseline sensitivity from the initial calibration reflector.

c) A DAC/TCG curve shall be established as defined by the procedure to establish reference sensitivity.

Manual ultrasonic weld testing shall be performed at a scanning sensitivity of DAC/TCG reference sensitivity, plus transfer correction with an additional 6-dB scanning gain. All indications that exceed 50 % DAC/TCG screen height shall be evaluated.

Evaluation sensitivity for manual ultrasonic weld testing should be DAC/TCG reference sensitivity, including transfer and +6dB scanning gain with an evaluation level for all imperfections at 50% of DAC/TCG screen height.

The procedure shall define the scanning and evaluation levels based on demonstration.

11.4.6.8 Inspection Error

When MUT is used for the determination of vertical height for either 9.6 or Annex A application, the inspection error of the procedure and technique shall be known. The inspection error shall be derived by a methodology agreed between contractor and company and confirmed by demonstration.

11.4.6.9 Acceptance Standards

The acceptance standards shall be defined by 9.6 or Annex A. The acceptance standards shall be incorporated into the MUT procedure and approved by the company.

11.4.7 Automated Ultrasonic Testing

11.4.7.1 General

AUT procedures shall be developed by the contractor. The company shall approve all AUT procedures prior to use for project inspection.

11.4.7.2 Procedure Requirements

At a minimum, the procedure for AUT of welds shall include the following specific application details:

a) type of welds to be tested, joint preparation dimensions, and welding processes;

b) material type (i.e., size, grade, thickness, process of manufacturing per API 5L);

c) scanning surface preparation/condition;

d) stage at which the examination is to be performed;

e) ultrasonic instrumentation;

f) software and version;

g) data management;

h) couplant and application;

i) testing technique(s):

   — description of technique to be applied, including sketches and showing weld coverage;

   — angle(s) inclusive of horizontal and vertical beam profiles;

   — transducer configuration(s);

   — frequencies (MHz);

   — temperatures and ranges;

   — scanning patterns and speeds;

   — reference datum and location markers (i.e., root face and circumferential location).

j) reference standards: detailed sketches showing plan view and cross-section view dimensions of production material reference standard blocks and all reference reflectors inclusive of machining tolerances;

k) calibration requirements:

   — the interval at which calibration of the instrument is required;

   — the sequence of startup prior to inspecting welds;

   — all calibration standards to be used;

   — the reference sensitivity reflectors to be used;

   — the reference sensitivity level settings;

- the requirements for verification of calibration settings.

l) scanning level: the sensitivity setting in dB to be added to the reference sensitivity for scanning;

m) evaluation level: the level or height of echoes detected during scanning at which further evaluation is required, and any sensitivity adjustment to be made before evaluating for acceptance or rejection;

n) imperfection sizing methodology;

o) record of results: type of record (e.g., sketch, image, scan, etc.);

p) reporting requirements:

- indications to be reported;
- weld status (accept/reject);
- defect classification;
- defect height;
- defect length;
- defect locations (circumferential, radial, axial position);
- weld repair or cutout;
- final disposition of the weld.;

q) ultrasonic examination report: an example of the examination reports;

r) example of the weld inspection scan.

11.4.7.3 Reference Standards

Reference standard(s) shall include artificial reflectors positioned to represent the orientation, shape, and location of flaws inherent to the welding process. This standard shall be used for calibration (i.e., time of flight, gating, and sensitivity) of the AUT system. The reference standard should include but is not limited to the following reference reflectors:

a) flat bottom hole(s) or notches;

b) centerline reflectors;

c) surface notches;

d) embedded notches;

e) transverse reflectors.

The reference standard shall be used in conjunction with the AUT system to ensure full volumetric coverage and detectability of the typical flaws in the weld. Reflectors should be spaced so that no two reflectors will be within the beam spread of one beam simultaneously. The reference standard shall be approved by the company.

Prior to use, the reference standard shall be verified. The verification shall include mechanical and manual ultrasonic checks defined in a procedure approved by the company. These checks shall be performed to ensure the reference standard’s suitability for use.

Examples of AUT required calibration reference blocks are show in Figure 32, Figure 33, and Figure 34. These examples are intended to provide visualization of the various required flat bottom reflectors and their role in providing weld area coverage. These examples do not represent a minimum number of reflectors required nor the types of reflectors that can be used. The design requirements for a calibration block shall be based on the location, geometry, and morphology of the indigenous weld flaws to be found in the welding process being inspected.

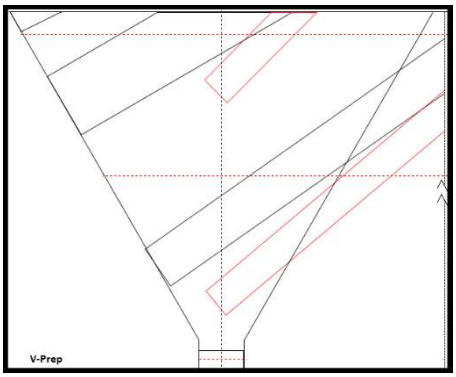


Figure 32—Example: V Prep Reference Standard—Example Reflector Positioning

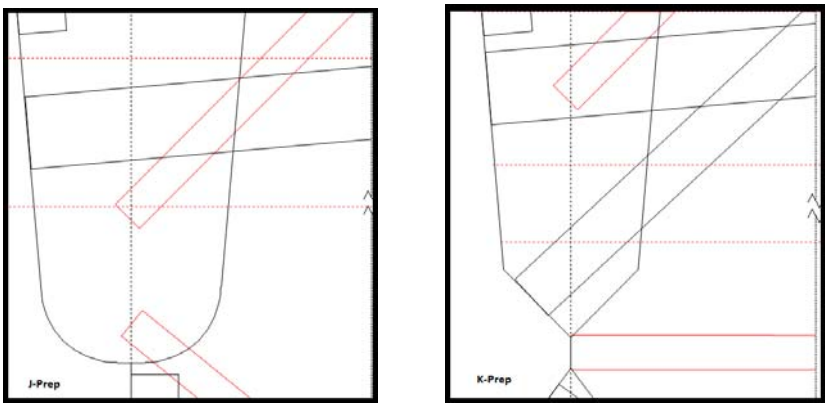


Figure 33—Example: J and K Prep Reference Standard—Reflector Positioning

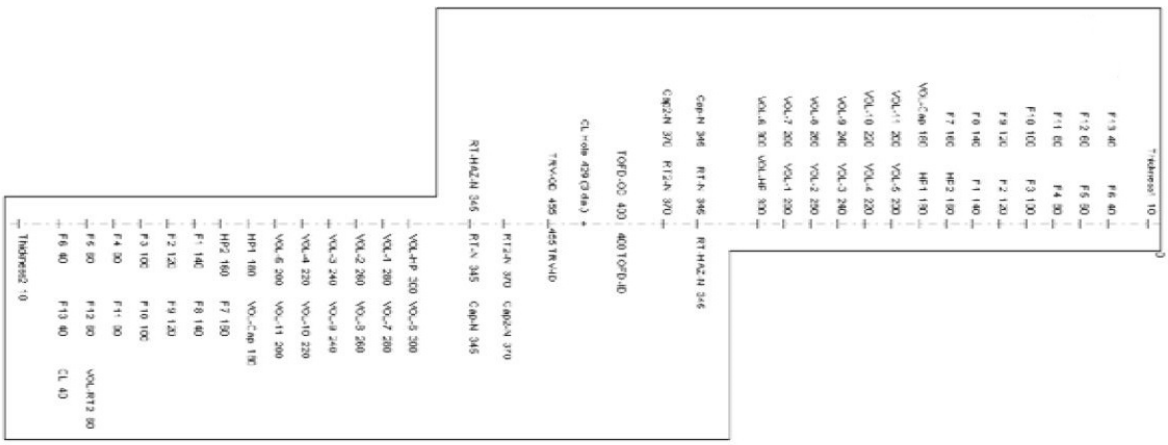


Figure 34—Example: J Prep Reference Standard—Top View

11.4.7.4 Reference Sensitivity, Scanning, and Evaluation Level

Reference sensitivity, scanning, and evaluation levels shall be proposed by the contractor. Final determination will be based on demonstration results with final approval from the company.

11.4.7.5 Inspection Error

When AUT is used for the determination of vertical height for either 9.6 or Annex A applications, the inspection error of the procedure and technique shall be known. The inspection error shall be derived by a methodology agreed between contractor and company and confirmed by demonstration.

11.4.7.6 Acceptance Standards

The acceptance standards shall be defined by 9.6 or Annex A. The acceptance standards shall be incorporated into the AUT procedure and be approved by the company.

11.4.8 Alternative Ultrasonic Techniques

Alternative ultrasonic techniques not described in this section may be proposed. The contractor shall provide sufficient development data prior to consideration for any qualification. Qualification and demonstration of the proposed procedure and technique shall be agreed between contractor and company prior to project use.

12 Mechanized Welding with Filler Metal Additions

12.1 Acceptable Processes

Mechanized welding shall be performed using one or more of the following processes:

a) submerged arc welding;

b) gas metal arc welding;

c) gas tungsten arc welding;

d) flux-cored arc welding with or without external shielding;

e) plasma arc welding;

f) the use of a manual or semiautomatic process combined with one of the mechanized processes listed in this section.

12.2 Procedure Qualification

Before production welding is started, a detailed WPS shall be established according to the requirements of 12.4 and qualified according to the requirements of 12.5 to demonstrate that welds with suitable mechanical properties (such as strength, ductility, and hardness) and soundness can be made by the procedure. Two base material lengths, full joints or nipples, shall be joined by following all the details of the WPS. The quality of the weld shall be determined by both destructive and nondestructive testing and shall meet the requirements of 12.6 and Section 9, respectively.

Should a welding procedure qualification utilize a manual or semiautomatic pass as outlined in 12.1, the nick break test in 5.6.3 shall be required as part of the procedure qualification unless procedure welds are examined by radiography or ultrasonic testing and are found acceptable per Section 9. The essential variables of Section 5 shall apply to the manual or semiautomatic portion of the weld, except that 5.4.2.2 and 5.4.2.3 shall be replaced by 12.5.2.2 and 12.5.2.3.

12.3 Record

The details of each procedure qualification shall be recorded. The record shall document at a minimum the actual observed values for the variables to be specified per 12.4 and the complete results of the procedure qualification tests. The record shall be maintained as long as the procedure is in use.

NOTE An example of an acceptable form is shown in Figure 35.

12.4 Welding Procedure Specification

12.4.1 General

The WPS should include all the information that is pertinent to setting up and maintaining the proper operation of the equipment. At a minimum, all the variables listed in 12.4.2 shall be specified in the WPS.

NOTE An example of an acceptable form is shown in Figure 36.

12.4.2 Specification Information

12.4.2.1 Welding Process

The specific process or combination of processes used shall be specified. This shall include a description of the equipment to be used.

12.4.2.2 Materials

The SMYS range of the materials to which the procedure applies shall be specified.

12.4.2.3 Diameters

The range of nominal ODs over which the procedure is applicable shall be specified in the WPS.

12.4.2.4 Wall Thickness and Number and Sequence of Beads

The range of nominal wall thicknesses over which the procedure is applicable shall be specified in the WPS, as shall the range of number of beads required for the thicknesses and the machine used for each bead.

PROCEDURE / WELDING OPERATOR QUALIFICATION RECORD

Date_____ Test No. _____ Test Type: ____WPQT ____WQT

Location _____

Welding Operator(s) Name_____ Welding Operator(s) Number_____

Material Grade 1 _____

Material Grade 2 _____

Outside Diameter_____ Wall Thickness_____

Joint Type_____ Bevel Angle(s)_____ Root Face_____ Root Gap_____

Backing Type (if applicable) _____ Welding Position(s)_____

WPS number (if applicable) _____

Method of heating _____ Width to be heated_____

For Plasma Arc Welding only: orifice diameter and gas composition _____

RECORDED WELDING PARAMETERS

Pass	Process and Transfer Mode	Polarity	Filler Metal Group or Classification and Size	Shielding Gas type and flow rate or Shielding Flux	Minimum and Maximum Preheat / Interpass Temperature	Voltage Range	Amperage Range	Wire Speed Range	Travel Speed Range	Heat Input Range
Root Bead										
Second Bead										

Note: Number of weld beads are not intended to be limited by this table and the table should be adjusted to present all required passes.

Time Between Passes: Root bead to 2nd bead: _____ , 2nd bead to 3rd bead:_____

Cooling Method (if applicable) _____ PWHT_____

MECHANICAL TEST RESULTS

TENSILE TESTS Report Number:

Specimen Number	Tensile 1	Tensile 2	Tensile 3	Tensile 4
Location				
Original specimen dimensions				
Original specimen area				
Maximum load				
Tensile strength				
Fracture location				

BEND TESTS Report Number:

Specimen Type and Number								
Location								
Result								

If the test weld combines mechanized and manual or semiautomatic processes, a table for Nick Breaks shall be added

NDT report number		
NDT Result		

Remarks

Test made at _____ Date _____

Tested by _____ Supervised by _____

Figure 35—Sample Coupon Test Report

WELDING PROCEDURE SPECIFICATION

Date _____ WPS Number _____

Material grade qualified _____

Outside Diameter range qualified _____ Wall Thickness range qualified _____

Backing type (if applicable) _____ Welding position(s) _____

Direction of welding _____ Direction of welding qualified _____

Minimum preheat temperature _____ Maximum interpass temperature _____

Method of heating _____ Width to be heated _____

Filler metal(s) and Flux _____ Cleaning and/or grinding tools _____

Type and removal of lineup clamp _____ Minimum number of passes _____

Method of cooling _____ PWHT procedure _____

Purging gas composition and flow (if applicable) _____

For Plasma Arc Welding only: orifice diameter and gas composition _____

Other variables:

JOINT DESIGN (define as a minimum joint type, bevel, angle, root face dimension, and root gap dimension and associated tolerances)	SEQUENCE OF BEADS

WELDING PARAMETERS

Pass	Process and transfer mode	Polarity	Filler Metal Group or Classification and size	Shielding Gas type and flow rate or Shielding Flux	Minimum and Maximum Interpass Temperature	Voltage Range	Amperage Range	Wire Speed Range	Travel Speed Range	Heat Input Range
Root Bead										
Second										

Note: Number of weld beads are not intended to be limited by this table and the table should be adjusted to present all required passes.

Remarks

Supporting procedure qualification record No(s). _____

Approved by: _____

Figure 36—Sample Welding Procedure Specification Form

12.4.2.5 Joint Design and Weld Shape and Size

The specification shall include a sketch or sketches of the joint that show the type of joint (e.g., V, U, K, etc.), the angle of bevel, and the size of the root face and root opening (with tolerances). The cap height and width beyond the groove shall be shown (with tolerances). If a backing is used, the type of backing shall be specified.

12.4.2.6 Filler Metal and Flux

The AWS classification number of the filler metal and flux, if available, shall be specified or the brand number of the shielding flux shall be specified in the WPS.

12.4.2.7 Size of Filler Metal

The size of the filler metal shall be specified in the WPS.

12.4.2.8 Electrical Characteristics, Travel Speed, and Heat Input

The following variables shall be specified in the WPS for each size or type of electrode used and/or each pass or pass grouping:

a) transfer mode;

b) polarity;

c) amperage;

d) voltage;

e) travel speed;

f) wire speed;

g) heat input.

12.4.2.9 Position

The welding position shall be specified in the WPS.

12.4.2.10 Direction of Welding

For fixed position welding, the direction of welding (vertical up, vertical down, or orbital) shall be specified in the WPS.

For roll welding, the rotation direction and position of the arc shall be specified in the WPS.

12.4.2.11 Type and Removal of Lineup Clamp

The specification shall indicate whether the lineup clamp is to be internal or external, or if no clamp is required. If a clamp is used, the minimum percentage of root bead welding that shall be completed before the clamp is released shall be specified.

12.4.2.12 Cleaning

The specification shall describe the joint end and interpass cleaning required.

12.4.2.13 Preheat and Interpass Temperature

The methods, width to be heated, minimum preheat temperature, minimum ambient temperature below which preheat is required (if applicable), and maximum interpass temperature shall be specified in the WPS.

12.4.2.14 Postweld Heat Treatment (PWHT)

The methods, width to be heated, minimum and maximum temperature, time at temperature, and temperature control methods for PWHT shall be specified.

12.4.2.15 Shielding/Purging Gas and Flow Rate

If used for welding, the composition of the shielding and/or back purging gas and the range of flow rates shall be specified in the WPS.

The composition of the gas used shall be defined by the designation of AWS A5.32.

12.4.2.16 Method of Cooling After Welding

The type of cooling after welding, such as air cooling or forced cooling with water to expedite nondestructive examination and joint coating, as well as the maximum metal temperature at which forced cooling is applied, shall be specified in the WPS.

12.4.2.17 Orifice Diameter or Orifice Gas Composition

For plasma arc welding, the orifice gas nominal composition and the orifice diameter shall be specified in the WPS.

12.4.2.18 Other Factors

Other important factors that may be necessary for proper operation of the process or that may affect the quality of the work produced (e.g., the location and angle of arc for fixed position welding, the contact-tube-to-work distance, and the oscillation width and frequency) shall be specified in the WPS.

12.5 Essential Variables

12.5.1 General

A welding procedure shall be reestablished as a new welding procedure specification and shall be completely requalified when any of the essential variables listed in Table 20 are changed outside of the ranges specified for each variable.

NOTE Changes of other variables (non-essential) may be made in the procedure without the need for requalification, provided the WPS is revised to show the changes.

12.5.2 Essential Variables Categories

The variables and qualification ranges specified in Table 20 are classified in two categories. Category I essential variables shall apply when specified hardness and/or toughness values are not required by the company. Category II essential variables shall apply when specified hardness and/or toughness values are required by the company.

Table 20—Essential Variables for the Qualification of Mechanized Welding Procedure Specifications

Welding Variable Subsection[a]	Change Requiring Requalification	Category I (Standard WPS)	Category II (Hardness and/or Toughness)
12.5.2.1 Welding Process	A change in welding process for any given pass or pass grouping	X	X
12.5.2.2 Base Material	a) A change in base material "nominal SMYS" greater than that of the base material used during qualification. When a procedure qualification test uses two different "nominal SMYS" materials, the procedure shall only be qualified to weld joints where at least one of the base materials is equal to or less than the lowest "nominal SMYS" base material used during qualification.[b, c]	X	X
	b) Where t is the nominal pipe wall thickness used during qualification, a change that falls outside the following ranges: 1) t to 2t, when $t \leq 0.188$ in. (4.8 mm) 2) 0.188 in. (4.8 mm) to 2t, when 0.188 in. (4.8 mm) < t ≤ 0.375 in. (9.5 mm) 3) 0.5t to 2t, when 0.375 in. (9.5 mm) < t < 1.0 in. (25.4 mm) 4) 0.5t to unlimited, when $t \geq 1.0$ in. (25.4 mm)	X	
	c) A change in nominal wall thickness +/-25 % of the wall thickness used during qualification.		X
	d) Where D is the nominal outside diameter of the pipe used during procedure qualification, a change that falls outside the following ranges: 1) 0.5D to 2D, when D < 12.75 in. (323.9 mm) 2) 0.5D to unlimited, when $D \geq 12.75$ in. (323.9 mm)	X	X
12.5.2.3 Joint Design	a) A change of type of joint (as defined in 12.4.2.5).	X	X
	b) A change of the bevel angle used during qualification that falls outside the following ranges:[d] 1) ±2° when bevel angle ≤ 10°; 2) ±5° when 10° < bevel angle < 30°; 3) ±10° when bevel angle is ≥ 30°.	X	X
	c) A change of root face by more than 50 % if the root pass is done with mechanized welding. An increase of root gap by more than 0.010 in. (0.25 mm) or 50 % of the root gap qualified, whichever is greater, if the root pass is done with mechanized welding.	X	X
12.5.2.4 Filler Metal and Flux	a) A change from one filler metal group to another (see Table 21) when base material SMYS is less than the "nominal SMYS" of Grade X65[b, e]	X	
	b) A change in filler metal AWS classification when the base material SMYS is greater than or equal to the "nominal SMYS" of grade X65[b, f]	X	
	c) A change in shielding flux outside of the limits specified in footnote "a" of Table 21.	X	
	d) A change in filler metal AWS classification.[f]		X
	e) A change in filler metal size.	X	X
12.5.2.5 Position	A change in position from roll welding to fixed position but not vice versa	X	X
12.5.2.6 Direction of welding[g]	a) A change from vertical up to vertical down and vice versa.	X	X
	b) A change from vertical up or vertical down to orbital but not vice versa.	X	X

Table 20—Essential Variables for the Qualification of Mechanized Welding Procedure Specifications (continued)

Welding Variable Subsection[a]	Change Requiring Requalification	Category I (Standard WPS)	Category II (Hardness and/or Toughness)
12.5.2.7 Shielding/ Backing Gas	a) A change of shielding gas or purging gas classification in accordance with AWS A5.32.	X	X
	b) A change in shielding gas flow rate greater than 20 % below the minimum flow rate recorded during qualification.	X	X
	c) The deletion of purging or shielding gas.	X	X
12.5.2.8 Orifice Diameter or Orifice Gas Composition	a) For plasma arc welding, a change in orifice gas nominal composition.	X	X
	b) For plasma arc welding, a change in orifice diameter.	X	X
12.5.2.9 Electrical Characteristics [h]	a) A change in current/polarity type (DCSP/DCEN, DCRP/DCEP, AC).	X	X
	b) A change to or from a wave form process.	X	X
	c) A change in heat input exceeding +/- 20 % of that recorded during procedure qualification. [i]	X	X
12.5.2.10 Preheat Temperature	a) The deletion of preheating when preheating is applied during qualification.	X	X
	b) A decrease in minimum base material preheat temperature more than 50 °F (30 °C) below that recorded during procedure qualification. [j]	X	X
12.5.2.11 Interpass Temperature	An increase in the maximum interpass temperature by more than 50 °F (30 °C) above that recorded during procedure qualification. [j]	X	X
12.5.2.12 Postweld Heat Treatment	The addition of PWHT or a change from the ranges or values specified in the PWHT procedure shall each constitute an essential variable	X	X
12.5.2.13 Cooling	a) The addition of deliberate cooling methods.	X	X
	b) A change in the method of deliberate cooling after welding resulting in a higher rate of cooling	X	X
	c) An increase in the maximum weld temperature prior to deliberate cooling	X	X

[a] The subsection numbers in this column are provided for referencing purposes.
[b] "Nominal SMYS" is in reference to the material grade and intended to negate the slight differences in actual SMYS between material type of the same grade. For example an API 5L X60 pipe and an ASTM A860 WPHY 60 fitting shall both be considered to have a "nominal SMYS" of 60 ksi.
[c] In addition to SMYS, the compatibility of the base materials of different analysis and filler metals should be considered from the standpoint of metallurgical and mechanical properties and requirements for preheat and PWHT.
[d] For compound bevels, the bevel angle allowances shall apply to each bevel angle accordingly.
[e] Changes in filler metal may be made within the groups in Table 21. The compatibility of the base material and the filler metal should be considered from the standpoint of mechanical properties.
[f] When under more stringent CVN requirements (projects with test temperature below 0 °F (-18 °C) or with minimum absorbed energy requirement of 37 ft-lbs (50J) or higher), or if a consumable with a "-G" classification is used, it is important to analyze the certificates of each lot used in production and ensure they have a similar chemical composition of the one used during qualification as defined by the company.
[g] Direction of welding only applies to fixed position welding.
[h] Unless otherwise specified by company requirements, the above noted parameters should be recorded as averages representative of a weld pass or specific segment of a weld pass. Sampling of parameters for waveform-controlled processes should be at a sampling frequency no less than 10 kHz. The method used for recording and calculating heat input during production monitoring should be the same as that used during procedure qualification.
[i] As calculated in 5.3.2.6.
[j] When procedures are qualified with different preheat and/or interpass temperatures throughout the weld sequence, the temperatures shall be specified accordingly.

Table 21—Filler Metal Groups

Group	AWS Specification	AWS Electrode/Filler Metal Classification	AWS Flux Classification
4 [a]	A5.17	EL8, EL8K, EL12, EL12K, EL12K, EM12, EM12K, EM13K, EM14K, EM15K	F7A0, F7A2, F7A4, F7A6, F7A8 F7P0, F7P2, F7P4, F7P6, F7P8
5 [b]	A5.18	ER70S-2, ER70S-3, ER70S-6	—
	A5.28	ER70S-A1, ER80S-D2, ER80S-Ni1, ER80S-Ni2, ER80S-Ni3	—
6	A5.2	RG60, RG65	—
7	A5.20	E71T-1C, E71T-1M, E71T-9C, E71T-9M, E71T-12C, E71T-12M, E71T-12M-J	—
	A5.36	E71T-1C, E71T-1M, E71T-9C, E71T-9M, E71T-12C, E71T-12M, E71T-12M-J	
8	A5.29	E81T-1Ni1C, E81T-1Ni1M, E81T1-1Ni2C, E81T-1Ni2M, E81T-1K2C, E81T-1K2M	—
	A5.36	E81T-1Ni1C, E81T-1Ni1M, E81T1-1Ni2C, E81T-1Ni2M, E81T-1K2C, E81T-1K2M	—

NOTE 1 Other electrodes, filler metals, and fluxes may be used but require separate procedure qualification.

NOTE 2 For any electrodes or filler metals with the "G" suffix designator (example ER80S-G) only, a change in the manufacturer or trade name is essential variable and each "G" electrode/filler metal require separate procedure qualification.

[a] Any combination of flux and electrode in Group 4 may be used to qualify a procedure. The combination is identified by its complete AWS classification number, such as F7A0-EL12 or F7A2-EM12K. Only substitutions that result in the same AWS classification number are permitted without requalification.

[b] A shielding gas (see 12.5.2.7) is required for use with the electrodes in Group 5.

12.6 Testing of Welded Joints—Butt Welds

12.6.1 Preparation

To test the butt-welded joint, test specimens shall be cut from the joint at the locations shown in Figure 37. The minimum number of test specimens and the tests to which they shall be subjected are given in Table 22. If the required number of test specimens cannot fit in a single weld, multiple test welds shall be performed. The specimens shall be air cooled to ambient temperature prior to being tested. The full-section specimens shall be tested in accordance with 12.6.2.2, 12.6.3.2, and 12.6.4.2, and shall meet the requirements of 12.6.2.3, 12.6.3.3, and 12.6.4.3.

Table 22—Type and Number of Test Specimens for Procedure Qualification Test

Outside Diameter of Pipe		Number of Specimens [a]				
in.	mm	Tensile Strength	Root Bend	Face Bend	Side Bend	Total
Wall Thickness ≤ 0.500 in. (12.7 mm)						
<2.375	<60.3	0 [b]	2	0	0	2
2.375 to 4.500	60.3 to 114.3	0 [b]	2	0	0	2
>4.500 to 12.750	>114.3 to 323.9	2	2	2	0	6
>12.750	>323.9	4	4	4	0	12
Wall Thickness > 0.500 in. (12.7 mm)						
≤4.500	≤114.3	0 [b]	0	0	2	2
>4.500 to 12.750	>114.3 to 323.9	2	0	0	4	6
>12.750	>323.9	4	0	0	8	12

[a] If more than one test weld is needed, at least one bend test and two tensile tests (when required) shall be taken from at least two separate coupons.

[b] For materials with SMYS greater than the material specified as API 5L Grade X42, a minimum of one tensile test is required.

12.6.2 Tensile Strength Test

12.6.2.1 Preparation

The full-thickness tensile strength test specimens shall be either of the types shown in Figure 38.

a) The sides of the full section specimen shown in Figure 38a shall be smooth and parallel. The specimen may be cut using any method, and no other preparation is needed unless the sides are notched or are not parallel.

b) The reduced section specimens shall be prepared as shown in Figure 38b. The weld reinforcement shall be removed.

12.6.2.2 Method

The tensile strength test specimens shall be broken under tensile load using equipment capable of measuring the load at which failure occurs. The tensile strength shall be computed by dividing the maximum load at failure by the smallest cross-sectional area of the specimen, as measured before the load is applied.

12.6.2.3 Requirements

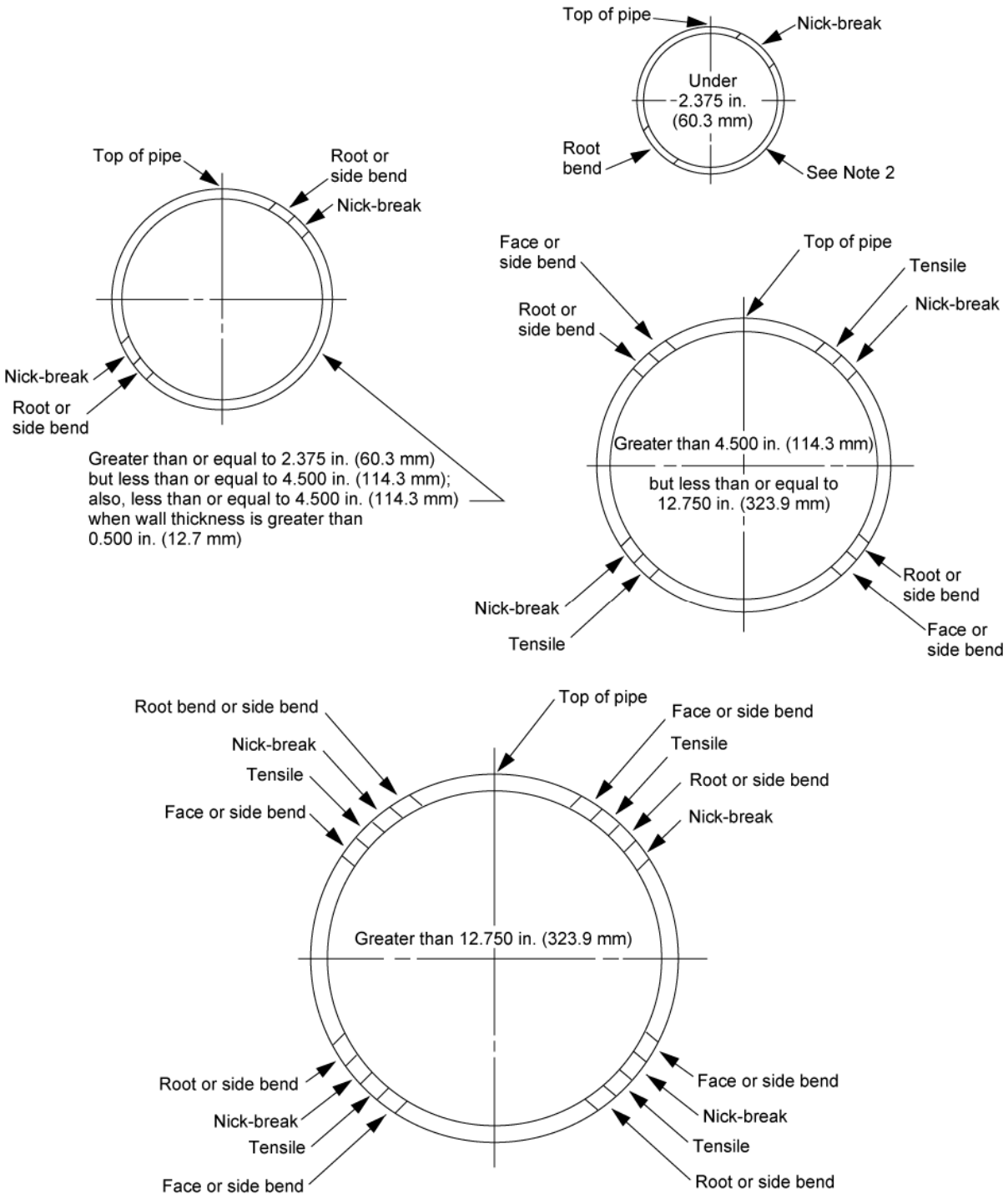
The tensile strength of the weld, including the fusion zone of each specimen, shall be greater than or equal to the specified minimum tensile strength (SMTS) of the pipe material but need not be greater than or equal to the actual tensile strength of the material. If the specimen breaks outside the weld and fusion zone (i.e., in the parent metal) at a tensile strength not less than 95 % of that of the SMTS of the pipe material, the weld shall be accepted as meeting the requirements.

If the specimen breaks in the weld or fusion zone and the observed strength is greater than or equal to the SMTS of the pipe material, the weld shall be accepted as meeting the requirements.

If the specimen breaks in the weld and below the SMTS of the pipe material, the weld shall be set aside and a new test weld shall be made.

When welding materials of different grades, the SMTS of the lower grade shall be used as the acceptance criteria.

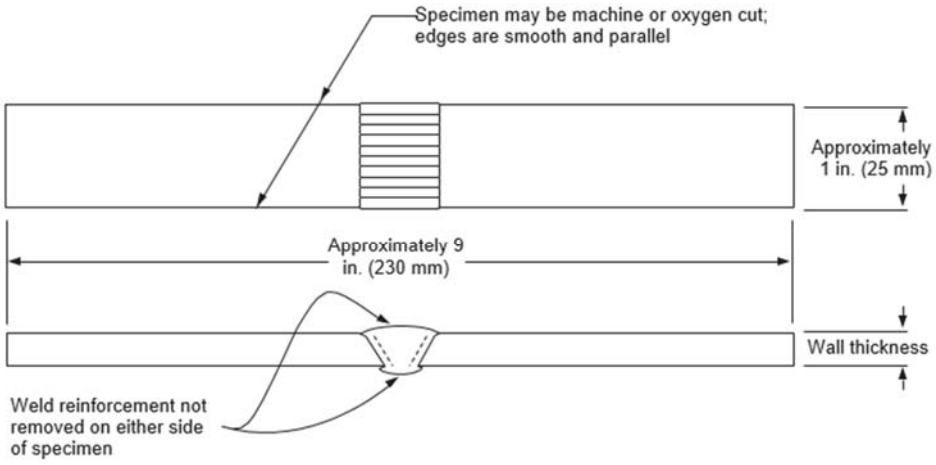
Any specimen that fails due to improper specimen preparation or testing may be replaced and retested.



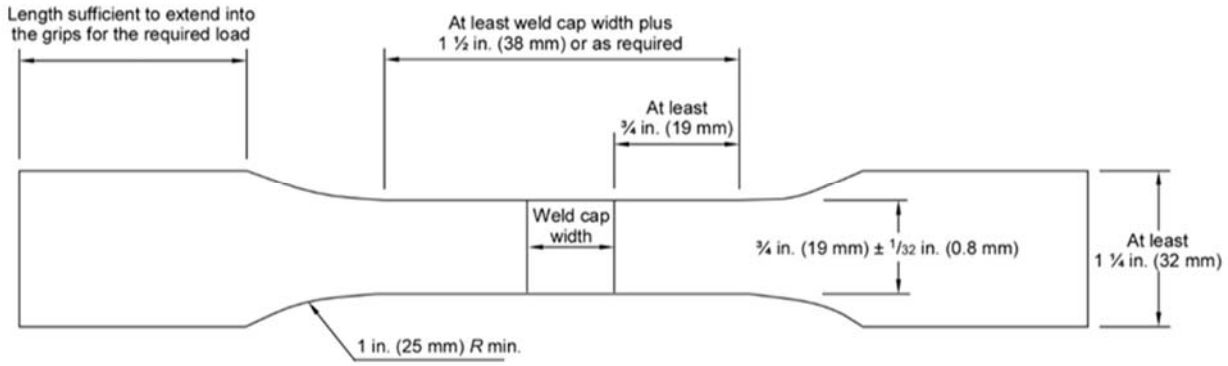
NOTE 1 At the company's option, the locations may be rotated, provided they are equally spaced around the pipe; however, specimens do not include the longitudinal weld.

NOTE 2 One full-section tensile specimen may be used for pipe with an outside diameter less than or equal to 1.315 in. (33.4 mm).

Figure 37—Location of Test Butt Weld Specimens for Procedure Qualification Test



a) Full Section Tensile Strength Test Specimen



b) Reduced Section Tensile Strength Test Specimen

Figure 38—Tension Test Specimen

12.6.3 Root and Face Bend Test

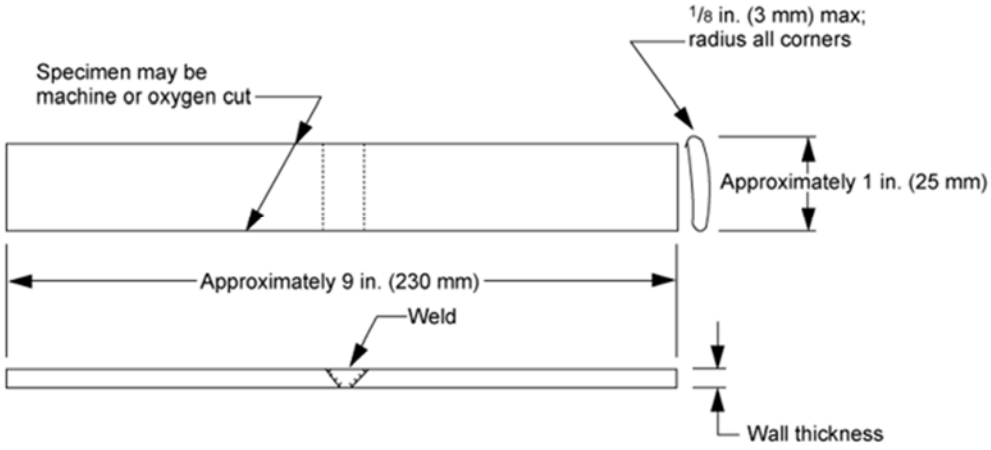
12.6.3.1 Preparation

The root and face bend test specimens (see Figure 39) shall be approximately 9 in. (230 mm) long and approximately 1 in. (25 mm) wide, and their long edges shall be rounded. They may be cut by any means.

The cover and root bead reinforcements shall be removed flush with the surfaces of the specimen. These surfaces shall be smooth, and any scratches that exist shall be light and transverse to the weld. The specimen shall not be flattened prior to testing.

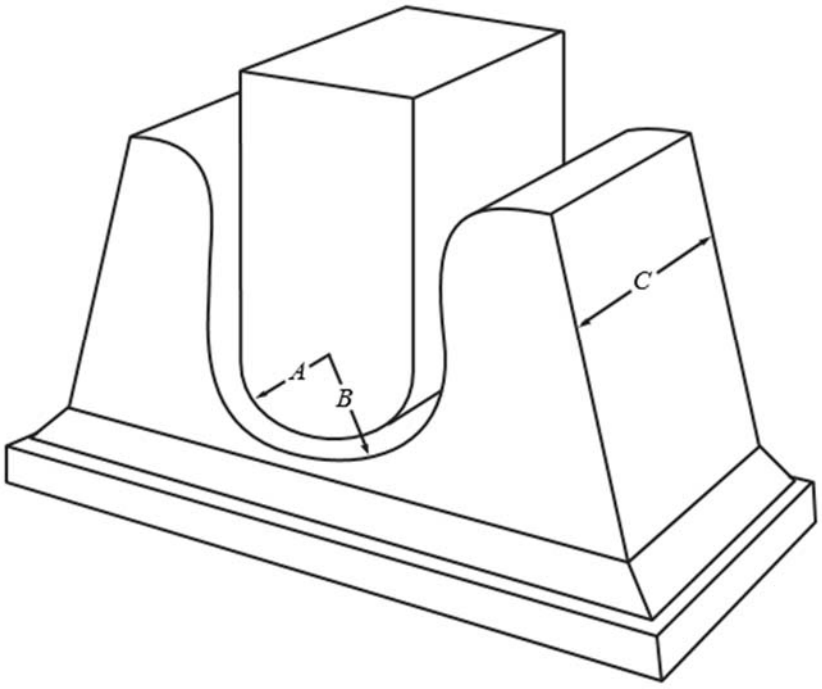
12.6.3.2 Method

The root and face bend specimens shall be bent with the weld transverse to the longitudinal axis of the specimen. Face bend specimens shall be bent so that the face is centered on the bend radius and becomes the convex surface of the bend specimen. Root bend specimens shall be bent so that the root is centered on the bend radius and becomes the convex surface of the bend specimen. The company shall specify the bend test fixture and bend radii. The radii shall not be greater than the radii specified in Figure 40.



NOTE The weld reinforcement is removed from both faces and made flush with the surface of the specimen. The specimen is not flattened prior to testing.

Figure 39—Root and Face Bend Test Specimen: Wall Thicknesses Less Than or Equal to 0.500 in. (12.7 mm)



NOTE This figure is not drawn to scale. Radius of plunger, A = 1 ¾ in. (45 mm); radius of die, B = 2 5/16 in. (60 mm); width of die, C = 2 in. (50 mm).

Figure 40—Jig for Guided-bend Tests

12.6.3.3 Requirements

The bend test shall be considered acceptable if no crack or other imperfection exceeding 1/8 in. (3 mm) or one-half the specified wall thickness, whichever is smaller, in any direction is present in the weld or between the weld and the fusion zone after bending. Cracks that originate on the outer radius of the bend along the edges of the specimen during testing and that are less than ¼ in. (6 mm), measured in any direction, shall

not be considered unless obvious imperfections are observed. For test weld diameter greater than 12 ¾ in. (323.9 mm), if only one bend specimen fails, the specimen should be replaced with two additional specimens from locations adjacent to the failed specimen. If either of the replacement bend test specimens fails, the weld is considered unacceptable.

12.6.4 Side Bend Test

12.6.4.1 Preparation

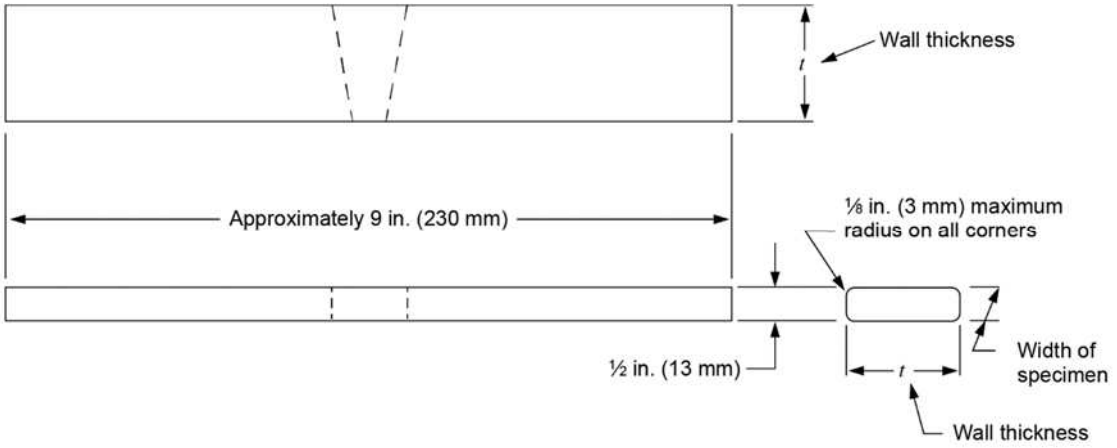
The side bend test specimens (see Figure 41) shall be approximately 9 in. (230 mm) long and approximately ½ in. (13 mm) wide, and their long edges shall be rounded. They shall be machine cut, or they may be cut by any means to approximately a ¾-in. (19-mm) width and then machined or ground to the ½-in. (13-mm) width. The sides shall be smooth and parallel. The cover and root bead reinforcements shall be removed flush with the surfaces of the specimen.

12.6.4.2 Method

The side bend specimens shall be bent with the weld transverse to the longitudinal axis of the specimen. Side bend specimens shall be bent so that one of the side surfaces is centered on the bend radius and becomes the convex surface of the bend specimen. The company shall specify the bend radii. The radii shall not be greater than the radii specified in Figure 40.

12.6.4.3 Requirements

Each side bend specimen shall meet the root and face bend test requirements specified in 12.6.3.3. For a test weld diameter greater than 12 ¾ in. (323.9 mm), a single failed side bend specimen may be replaced with two additional specimens from locations adjacent to the failed specimen. If either of the replacement bend test specimens fails, the weld is considered unacceptable.



NOTE All dimensions are approximate.

Figure 41—Side Bend Test Specimen: Wall Thicknesses Greater than 0.500 in. (12.7 mm)

12.7 Qualification of Welding Operators

12.7.1 General

Each welding operator shall be qualified by producing an acceptable weld using the qualified welding procedure. The completed weld shall be tested by destructive methods or nondestructive methods or both, and shall meet the requirements of 12.7.2 through 12.7.4. If the completed weld is tested by both destructive methods and nondestructive methods, failure to meet the acceptance criteria of either method shall result in rejection of the weld. Should a welding procedure qualification utilize a manual or semiautomatic pass as outlined in 12.1, the nick break and tensile strength test in 6.5.1 shall be required as part of the welding

operator qualification. It is possible to qualify a WPS and a welding operator with one test joint. It is the intent of this standard that a welding operator who satisfactorily completes the procedure qualification test shall be a qualified welding operator, provided the number of test specimens required by 12.7.3 have been removed, tested, and meet the acceptance criteria of 12.6.3 or 12.6.4, for each welding operator. In such cases, verified compliance to a WPS is not required as the welder will be establishing the WPS parameters as part of the qualification process. Replacement shall be allowed for the welding procedure qualification testing, even though the welding operator(s) was disqualified.

Prior to the start of welding, each welding operator shall have received adequate training in the operation of the welding equipment. If the welding procedure involves more than one operation, welding operators shall be qualified on the type of welding equipment that will be used in production welding.

Should a welding procedure utilize a combination of processes, it shall be acceptable to qualify a welding operator on one of the processes only. The welding operator shall be limited to performing that specific process.

At the option of the company, it shall be acceptable to qualify welding operators whose work is limited to specific weld passes in a multipass butt weld to those specific passes. The other weld passes necessary to make complete welds shall be made by other welding operators. Welding operators shall be qualified if all tests are acceptable.

Changes in the essential variables described in 12.7.6 require requalification of the welding operator.

12.7.2 Visual Examination

For a qualification test weld to meet the requirements for visual examination, the weld shall be free from cracks, inadequate penetration, and BT, and shall present a neat workmanlike appearance that is acceptable to the company. The depth of undercutting adjacent to the final bead on the outside of the pipe shall not be more than $^{1}/_{32}$ in. (0.8 mm) or 12.5 % of the pipe wall thickness, whichever is smaller, and there shall not be more than 2 in. (50 mm) of undercutting in any continuous 12-in. (300-mm) length of weld.

Filler wire protruding into the inside of the pipe shall be kept to a minimum and the company shall determine the acceptability of protruding wires.

Failure to meet the requirements of this section shall be adequate cause to eliminate additional testing.

12.7.3 Destructive Testing

12.7.3.1 Sampling of Test Butt Welds

When destructive tests are requested to test butt welds, samples shall be cut from each test weld. The total number of specimens and the tests to which each shall be submitted are shown in Table 23.

Table 23—Type and Number of Test Specimens for Welding Operator Qualification Test

Outside Diameter of Pipe		Number of Specimens			
in.	mm	Root Bend	Face Bend	Side Bend	Total
Wall Thickness ≤ 0.500 in. (12.7 mm)					
<2.375	<60.3	2	0	0	2
2.375 to 4.500	60.3 to 114.3	2	0	0	2
>4.500 to 12.750	>114.3 to 323.9	2	2	0	4
>12.750	>323.9	4	4	0	8
Wall Thickness > 0.500 in. (12.7 mm)					
≤4.500	≤114.3	0	0	2	2
>4.500 to 12.750	>114.3 to 323.9	0	0	4	4
>12.750	>323.9	0	0	8	8

If the test weld is a complete circumferential weld, bend test specimens should be removed from locations similar to bend tests in Figure 37. If the test weld consists of segments of pipe nipples, an approximately equal number of specimens shall be removed from each segment. The specimens shall not include the longitudinal weld. The specimens shall be air cooled to ambient temperature prior to testing.

For pipe with an OD less than or equal to 1.315 in. (33.4 mm), root bend specimens shall be removed from two qualification welds.

12.7.3.2 Bend Test Procedures

The specimens shall be prepared for bend tests, and the tests shall be performed as described in 12.6.3 or 12.6.4 as applicable.

If one of the bend test specimens fails to meet these requirements and, in the company's opinion, the imperfection observed is not representative of the weld, the test specimen should be replaced by an additional specimen cut adjacent to the one that failed.

The welding operator shall be disqualified if the additional specimen also shows imperfections that exceed the specified limits.

12.7.4 Nondestructive Testing (NDT)

12.7.4.1 General

At the company's option, the qualification butt weld may be examined by radiography or automated ultrasonic testing using a qualified NDT procedure instead of or in addition to the tests specified in 12.7.3.

12.7.4.2 Inspection Requirements

When radiography is utilized, radiographs shall be made of each of the test welds. The welding operator shall be disqualified if any of the test welds do not meet the requirements of 9.3.

When automated ultrasonic testing is utilized, each test weld shall be fully examined. The welding operator shall be disqualified if any of the test welds do not meet the requirements of 9.6.

Radiographic testing or automated ultrasonic testing shall not be used for the purpose of locating sound areas or areas that contain imperfections and subsequently making tests of such areas to qualify or disqualify a welding operator.

12.7.5 Retesting

If, in the mutual opinion of the company and the contractor's representatives, a welding operator fails to pass the qualification test because of unavoidable conditions or conditions beyond the welding operator's control, the welding operator should be given a second opportunity to qualify. No further retests shall be given until the welding operator has submitted proof of subsequent welding operator training that is acceptable to the company.

12.7.6 Changes Requiring Requalification

Changes in the following essential variables shall require requalification of the welding operator.

a) A change in polarity, from one welding process or welding-process combination to another or a change from a waveform process to a non-waveform process.

b) A change in the direction of welding from:

   — vertical up to vertical down or vice versa;

   — vertical up or vertical down to orbital but not vice versa;

   — rolled to vertical up, vertical down, or orbital but not vice versa; and

   — vertical progression to horizontal progression or vice versa.

c) A change in the filler metal type (solid wire, metal core, flux core).

d) A change from one specified OD group to another, to include:

   — OD less than 12.75 in. (323.9 mm); and

   — OD equal to or greater than 12.75 in. (323.9 mm).

e) Wall thickness:

   1) If welding operator qualification weld is done on a pipe with a wall thickness less than 0.500 in. (12.7 mm), this operator shall be qualified for welding pipes with a wall thickness of $2t$ or less, where t is the wall thickness used during the qualification test;

   2) If a welding operator qualification weld is done on a pipe with a wall thickness equal to or greater than 0.500 in. (12.7 mm), this operator shall be qualified for welding pipes of any wall thickness.

f) A change in position from that for which the welding operator has already qualified (e.g., a change from rolled to fixed or a change from vertical to horizontal). A welding operator who qualifies in the fixed position shall also be qualified to perform rolled welds within the essential variables qualified.

g) A change in welding bug manufacturer or model.

h) A change in the method of applying the root bead (e.g., external root versus internal root).

i) A major change in joint design (e.g., from a V-groove to a U-groove or J-groove) or any change beyond the range established for such factors as spacing, root face, and angle of bevel.

j) A welding operator only welding a certain pass or pass grouping during the qualification weld shall be qualified for this specific pass or pass grouping only.

12.8 Records of Qualified Operators

A record shall be made of the tests required by 12.7 and of the detailed results of each test. A form similar to that shown in Figure 35 should be used (this form should be developed to suit the needs of the company and should be sufficiently detailed to demonstrate that the qualification test meets the requirements of this standard). A list of qualified operators and the procedures for which they are qualified shall be maintained. An operator may be required to requalify if a question arises about their competence.

12.9 Inspection and Testing of Production Welds

Production welds shall be inspected and tested in accordance with Section 8.

12.10 Acceptance Standards for NDT

The acceptance standards for NDT shall be in accordance with Section 9 or, at the company's option, Annex A.

12.11 Repair and Removal of Defects

Repair and removal of defects shall be in accordance with Section 10.

12.12 Radiographic Testing

Radiographic testing shall be in accordance with 11.1.

12.13 Ultrasonic Testing

Ultrasonic testing shall be in accordance with 11.4.

Annex A
(normative)

Alternative Acceptance Standards for Girth Welds

A.1 General

The acceptance standards given in Section 9 are based on empirical criteria for workmanship and place primary importance on imperfection length. Such criteria have provided an excellent record of reliability in pipeline service for many years. The use of fracture mechanics analysis and fitness-for-purpose criteria for determining acceptance criteria is an alternative method and incorporates the evaluation of both imperfection height and imperfection length. Typically, but not always, the fitness-for-purpose criteria provide more generous allowable imperfection length. Additional qualification tests, stress analysis, and inspection are required to use the fitness-for-purpose criteria. Performing analysis based on the principles of fitness-for-purpose is alternatively termed engineering critical assessment, or ECA.

The fitness-for-purpose criteria in the prior versions of this annex required a minimum crack tip opening displacement (CTOD) toughness of either 0.005 in. or 0.010 in. (0.13 mm or 0.25 mm) and were independent of any higher values of fracture toughness. Improvements in welding consumables and with more precise welding procedures, especially with the increased use of mechanized welding devices, have resulted in higher and more uniform toughness and ductility in most welds. At the same time, toughness values below 0.005 in. (0.13 mm) have been observed, particularly with more stringent notching procedures of CTOD specimens than those in the prior versions of this annex. Welds with CTOD toughness below 0.005 in. (0.13 mm) have shown to perform adequately when the acceptance criteria are properly adjusted to account for the lower toughness. The acceptance criteria are revised so that they are commensurate with the measured toughness and applied load levels.

This annex includes three options for the determination of acceptance limits of planar imperfections. In numerical order, the options are increasingly complex in application but offer wider range of applicability. Option 1 provides the simplest methodology. Option 2 allows for the full utilization of the toughness of the materials, thus providing a more accurate criterion but requires more calculation. The first two options were developed with a single set of underlying procedures but are limited to applications with a low to moderate fatigue loading as described in A.2.2.1.[9] Option 3 is provided for those cases where fatigue loading exceeds the limit established for the first two options. Option 3 is not prescriptive, and its consistency could be significantly less than Options 1 and 2. Option 3 should only be exercised, when necessary, by skilled practitioners with demonstrated knowledge of fracture mechanics and pipeline load analysis.

It is usually impractical to qualify individual pipeline welds for the alternative acceptance limits after a defect under Section 9 is detected, because destructive testing is required to establish the required mechanical properties for the welding procedure under consideration.

This annex provides procedures to determine the maximum allowable imperfection sizes. It does not prevent the use of Section 9 for determining imperfection acceptance limits for any weld. Use of this annex is completely at the company's option.

In this annex, the use of the phrase imperfection acceptance limits and other phrases containing the word imperfection is not intended to imply a defective condition or any lack of weld integrity. All welds contain certain features variously described as artifacts, imperfections, discontinuities, or flaws. These terms are widely accepted and used interchangeably. The primary purpose of this annex is to define, on the basis of a technical analysis, the effect of various types, sizes, and shapes of such anomalies on the suitability of the whole weld for a specific service.

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[9] Y.-Y. Wang and M. Liu, "A Comprehensive Update in the Evaluation of Pipeline Weld Defects," U.S. DOT Agreement No. DTRS56-03-T-0008, PRCI Contract No. PR-276-04503, draft report to DOT and PRCI, November 2004.

This use of this annex is restricted to the following conditions:

— circumferential welds between pipes of equal specified wall thickness;

— nondestructive inspection performed for essentially all welds;

— no gross weld strength undermatching, see A.3.2.1;

— maximum axial design stress no greater than the SMYS;

— maximum axial design strain no greater than 0.5 %;

— welds in pump and compressor stations, fittings, and valves in the main line are excluded;

— Repair welds are excluded for Options 1 and 2, but can be assessed using Option 3 with the company's approval, see A.5.1.5.1.

A.2 Stress Analysis

A.2.1 Axial Design Stress

To use this annex, a stress analysis shall be performed to determine the maximum axial design stresses to which the girth welds may be subjected to during construction and operation. The stress analysis shall include stresses during pipeline installation and stresses induced by operational and environmental conditions.

NOTE Under typical onshore construction conditions, the highest axial stress may occur during the pipe lowering-in process. The lowering-in stress is predominantly controlled by the lift height of the pipe relative to the bottom of the trench and the lateral movement from the skids to the center of the trench. The stresses from horizontal directional drilling can be estimated from the curvature of the pipe path, pull force, and the interaction between the pipe and surrounding soil (including friction).[10] These stresses may reach their peak values at different times.

The maximum axial design stress shall be the maximum total axial stress at any given time during the design life of the pipeline.[11]

A.2.2 Cyclic Stress

A.2.2.1 Analysis

The cyclic stress analysis shall include the determination of the predicted fatigue spectrum to which the pipeline will be exposed over its design life. This spectrum shall include but is not limited to stresses imposed by hydrostatic testing, operation pressure, installation stresses, and, where applicable, thermal, seismic, and subsidence stresses. The spectrum should consist of several cyclic axial stress levels and the number of cycles applicable to each. If the stress levels vary from cycle to cycle, a suitable counting method, such as the rainflow method, should be used to determine cyclic stress levels and cycle count. [12]

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[10] More details of the stress analysis may be found in reference M. Liu, Y.-Y. Wang, and G. Rogers, "Stress Analysis of Pipe Lowering-in Process During Construction," Proceedings of the 7th International Pipeline Conference, Paper No. IPC2008- 64630, Calgary, Alberta, Canada, September 29-October 3, 2008.

[11] For consistency with the computation of the material's flow stress in this annex, stress-strain relations based on minimum specified values are recommended when converting axial strains to axial stresses. Using actual stress-strain relations may result in the overestimation of the applied load level, as the flow stress is computed from the minimum specified values (e.g., see A.5.1.3).

[12] For an example of the use of the rainflow method, see N. E. Dowling, "Fatigue Failure Predictions for Complicated Stress-Strain Histories," *Journal of Materials*, Volume 7, Number 1, pp. 71 to 87, March 1972.

The fatigue spectrum severity, S^*, is computed from Equation (A.1):

$$S^* = N_1 \left(\Delta\sigma_1\right)^3 + N_2 \left(\Delta\sigma_2\right)^3 + \ldots N_i \left(\Delta\sigma_i\right)^3 + \ldots + N_k \left(\Delta\sigma_k\right)^3 \quad \text{(A.1)}$$

where

S^* is the spectrum severity;

N_i is the number of cycles at the ith cyclic stress level;

$\Delta\sigma_I$ is the ith cyclic stress range, in kips per in.^{2} (ksi);

k is the total number of cyclic stress levels;

i is the number ith cyclic stress, from 1 to k.

If the spectrum severity is less than 5×10^6 and if the use of "steel in-air" crack growth curves in BS 7910 is appropriate, Options 1 and 2 acceptance criteria (A.5.1.3 and A.5.1.4) shall be applied without any further fatigue analysis. [13]

If the spectrum severity exceeds 5×10^6 and/or in-air crack growth curves are not applicable, Options 1 and 2 may be used with further analysis, or Option 3 procedures may be applied. [14]

A.2.2.2 Environmental Effects on Fatigue

The enlargement of weld imperfections due to fatigue is a function of stress intensity, cycles of loading, imperfection size, and the environment at the crack tip. In the absence of contaminating elements, oil and hydrocarbons are considered no worse than air. Water, brine, and aqueous solutions that contain CO_2 or H_2S may, however, increase the growth rate. It is normal for minor amounts of these components to be present in nominally noncorrosive pipelines. When the concentration of either CO_2 or H_2S exceeds typical historical levels experienced in noncorrosive pipelines, this annex shall not be used, unless evidence exists that the proposed levels do not result in acceleration of fatigue crack growth or adequate corrosion inhibition is applied. The effects of environment on fatigue crack growth external to the pipe at girth welds are normally mitigated by external coating and cathodic protection, and do not limit the use of this annex.

A.2.3 Sustained-load Cracking

Certain environments may enhance imperfection growth in service at sustained load or induce brittleness in the material surrounding the imperfection to the point that an otherwise dormant imperfection becomes critical. These environments typically contain H_2S, but may contain strong hydroxides, nitrates, or

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[13] The implied safety factor in the fatigue spectrum severity limit for Options 1 and 2 varies, depending on, for example, the pipe wall thickness and distribution of fatigue spectrum. For a wide range of onshore and offshore pipeline scenarios, the spectrum severity limit is estimated to provide a safety factor of more than 2 or 5 on cycles when the fatigue growth rates are based on mean+2 standard deviation or mean values of BS 7910 (e.g., Table 8.3, R > 0.5 in BS 7910:2019), respectively.

[14] Options 1 and 2 provide an adequate safety factor against fracture due to moderate cyclic loading provided the aforementioned "steel-in-air" curve is applicable. In other environments, for example, when determining allowable defect sizes at the OD of an offshore pipeline with fusion-bonded epoxy field joint coating and under cathodic protection, use of the "steel-in-air" curve is not appropriate and use of Options 1 or 2 may not be sufficiently conservative. Similarly, if cyclic loading exceeds the defined spectrum severity of 5×10^6, for example, due to cyclic stresses from offshore installation loads on a pipe lay stinger, use of Options 1 or 2 may also not be sufficiently conservative.

carbonates. When these materials are present inside the pipe, a minimum threshold stress shall be established, and this annex shall not be used if the calculated stress exceeds the threshold value. With respect to H_2S service, the definition of such service shall be that given in NACE MR0175/ISO 15156. Although external exposure to carbonates and nitrates in the soil has been shown to produce stress corrosion cracking (SCC) in a small number of cases, the cracking is normally axial and is associated with circumferential stress rather than axial stress. However, circumferential SCC failures may occur at locations where longitudinal stresses have increased over the life of the pipeline (e.g., at overbends above unstable slopes).

The frequency and severity of SCC can be mitigated using proper coating and proper cathodic protection. The use of this annex is not precluded when direct exposure to the aggressive environment is prevented by a coating designed to resist the environment.

A.2.4 Dynamic Loading

The stress analysis shall include consideration of potential dynamic loading on girth welds, such as loads from closure of check valves. This annex does not apply to welds strained at a strain rate greater than 10^{-3} second (a stress rate of 30 ksi/sec for steel).

A.2.5 Residual Stress

The effects of welding residual stress are accounted for by specifying the minimum CTOD toughness and Charpy energy, and by incorporating appropriate conservatism in Options 1 and 2 procedures (A.5.1.3 and A.5.1.4). The determination of residual stress is not required under these conditions. The effects of residual stress shall be evaluated for all time-dependent failure mechanisms, such as fatigue.

A.3 Welding Procedure

A.3.1 General

The controls of the variables necessary to ensure an acceptable level of fracture toughness in a welding procedure are more stringent than those controlling welding procedures without minimum toughness requirements. An appropriate quality control program shall be established to ensure welding is performed within the parameters of the qualified welding procedure. Qualification of welding procedures to be used with this annex shall be in accordance with Section 5 or Section 12 of this standard, with the additional mechanical property testing in accordance with A.3.4 and the essential welding variables listed in A.3.2.

A.3.2 Essential Variables

Any change in the essential variables listed in Table A.1 shall require requalification of the welding procedure.

Table A.1—Essential Variables for Qualification of Welding Procedure Specifications in Accordance with this Annex

Welding Variable Subsection[a]	Change Requiring Requalification
A.3.2.1 Welding Process	a) A change in welding process
	b) A change in mode of arc transfer
	c) A change in method of application (manual, semiautomatic, automatic)
A.3.2.2 Base Material	a) A change in the strength grade
	b) A change in the source/mill for steel (slabs, ingots, billets, etc.)
	c) A change in the processing facility for plate or coil used to make pipe
	d) A change in the pipe manufacturing facility
	e) A change in the pipe manufacturing process, including pipe forming and heat treatment process (EW, SAWL, SAWH, seamless, expanded vs. not expanded, heat treated vs. not heat treated)
	f) A change in chemistry outside the limits defined by the manufacturing procedure specification (MPS)[b] or, alternatively, if the pipe is not manufactured to an MPS, a change in any of the following: 1) increase in Pcm ≥ 0.02 for steels with carbon content ≤ 0.12 % [Pcm = C + Si/30 + (Mn+Cu+Cr)/20 + Ni/60 + Mo/15 + V/10 + 5B]; 2) increase in CE ≥ 0.03 for steels with carbon content > 0.12 % [CE = C + Mn/6 + (Cu + Ni)/15 + (Cr + Mo + V)/5]; 3) increase in C ≥ 0.02 %. Chemistry compositions requirements shall be based on heat analysis results.
	g) A change in wall thickness greater than ±0.125 in. (3.2 mm) from the wall thickness used during procedure qualification.
	h) A change in the specified pipe OD more than –0.25 D or +0.5 D, where D is the pipe OD of procedure qualification welds.
A.3.2.3 Joint Design	A major change in joint design.[c]
A.3.2.4 Position	a) A change in position from rolled to fixed
	b) A change from vertical to horizontal or vice versa
A.3.2.6 Time Between Passes	An increase in the time between the completion of the root bead and the start of the second bead. Not required for low hydrogen processes.
A.3.2.7 Direction of Welding	A change in direction (e.g., from vertical down to vertical up or vice versa).
A.3.2.8 Shielding Gas	a) A change from one AWS A5.32 shielding gas classification designation to another
	b) A change in the nominal qualified flow rate of shielding gas of more than ±10 %

Table A.1—Essential Variables for Qualification of Welding Procedure Specifications in Accordance with this Annex (continued)

Welding Variable Subsection[a]	Change Requiring Requalification
A.3.2.9 Shielding Flux	A change in the shielding flux, including a change in manufacturer within an AWS classification.
A.3.2.10 Electrical Characteristics	a) A change in the current/polarity type (DCSP/DCEN, DCRP/DCEP, AC)
	b) A change of more than ±10 % from the nominal heat input[d] range recorded for each weld pass during the procedure qualification[e]
A.3.2.11 Preheat Temperature	A change in the requirements for preheat temperature.
A.3.2.12 Interpass Temperature	A change in the interpass temperature,[f] if the interpass temperature is lower than the minimum interpass temperature recorded during the procedure qualification test or if the interpass temperature is 45 °F (25 °C) higher than the maximum interpass temperature recorded during the procedure qualification test.
A.3.2.13 Postweld Heat Treatment	A change in the PWHT requirements.

[a] The subsection numbers in this column are provided for referencing purposes.

[b] For MPS-controlled chemistry, the user is advised to consider if the chemistry limits are sufficient to ensure the desired level of weld mechanical performance.

[c] Minor changes in the angle of bevel or the land of the welding groove are not essential variables.

[d] As calculated in 5.3.2.6.

[e] Unless otherwise specified by company requirements, the parameters should be recorded as averages representative of a weld pass or specific segment of a weld pass. Sampling of parameters for waveform-controlled processes should be at a sampling frequency no less than 10 kHz. The method used for recording and calculating heat input during production monitoring should be the same as that used during procedure qualification.

[f] As defined in 3.1.29.

Table A.2—Allowed Range of Variation from the Targeted Mean Values for a Lot Defined by Controlled Chemical Composition (see A.3.2.5)

Alloying Element	Solid Wire Composition	Metal-cored Electrode Weld Deposit
%C	±0.02	±0.02
%Mn	±0.10	±0.15
%Si	±0.10	±0.10
%Ni	±0.10	±0.10
%Cr	±0.05	±0.05
%Mo	±0.05	±0.05
%Ti	±0.01	±0.02
%V	±0.02	±0.02
%Nb	±0.01	±0.01
%Cu	±0.05	±0.05
%P	±0.005	±0.005
%S	±0.005	±0.005
%B	±0.001	±0.002

A.3.3 Qualification of Multiple Pipe Sources

For low-dilution welding processes, such as mechanized gas metal arc welding, the qualification of a common weld procedure for multiple pipe materials as defined by A.3.2.2 a) through f) may be achieved by ensuring:

a) each material HAZ is CTOD tested per A.3.4.3.3;

b) each material HAZ is CVN tested per A.3.4.2;

c) cross-weld tensile testing is performed on all test weld combinations used in Items a) or b).

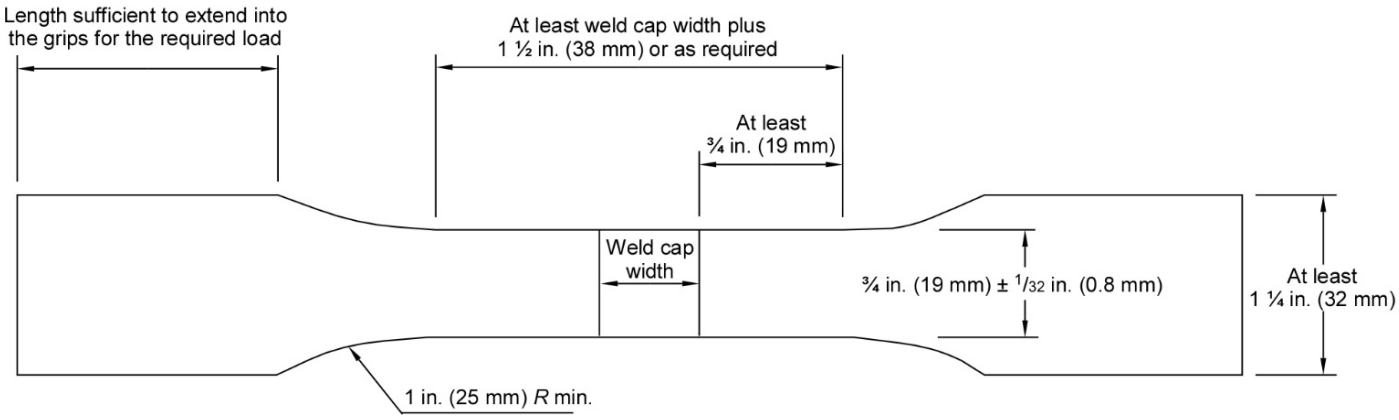
It shall not be necessary to test welds made with all possible combinations of pipe material.

A.3.4 Testing of Weld Joints—Butt Welds

A.3.4.1 Weld Tensile Properties

A.3.4.1.1 Specimen Preparation and Testing

The test specimens shall be of rectangular cross-section with reduced width at the mid-length region. The number and location of specimens shall be as indicated in Table 3 and Figure 3 in Section 5. The specimen dimensions shall be as indicated in Figure A.1. The weld reinforcement shall be removed. The weld shall be centered nominally in the length of the reduced section. The ends of the specimens shall be sufficient for the grips.



NOTE The reduced section shall be parallel within 0.010 in. (0.25 mm)

Figure A.1—Top View (Width in Circumferential Direction) of the Tensile Test Specimen

A.3.4.1.2 Requirements

The requirements for the weld based on the mechanical property test results shall be as follows:

a) If the specimen breaks at a strength equal to or greater than the SMTS of the pipe, the result is acceptable and no further testing is required. Although tensile specimen failure in the weld is acceptable, provided the strength requirement is met, gross weld strength undermatching should be avoided. [15]

[15] The company is cautioned to consider weld undermatching issues as they relate to pipeline bending or other longitudinal tensile loads. An example of assessing weld strength undermatching is given in Y.-Y. Wang, M. Liu, D. Horsley, and G. Bauman, “A Tiered Approach to Girth Weld Defect Acceptance Criteria for Stress-based Design of Pipelines,” 6th International Pipeline Conference, Paper No. IPC2006-10491, Calgary, Alberta, Canada, September 25-29, 2006.

b) If the specimen breaks in the weld or HAZ at a strength below the specified maximum yield strength of the pipe material (API 5L, PSL 2), the weld shall be rejected.

c) If a specimen breaks outside the weld or HAZ at a tensile strength less than 100 %, but not less than (lower than) 95 % of the SMTS of the pipe material, two additional specimens may be tested. Both retest specimens shall meet the SMTS of the pipe material. If either retest specimen fails to meet the minimum tensile strength requirement, no retesting is permitted.

d) Any specimen that breaks outside the weld or HAZ at a tensile strength less than (lower than) 95 % of the SMTS of the pipe material shall be rejected, and no further retesting is permitted.

A.3.4.2 Charpy Impact Energy

A.3.4.2.1 Specimen Preparation

Charpy V-notch impact test specimens shall be prepared with their lengths parallel to the pipe axis. The largest size specimens permitted by the pipe wall thickness should be used. The thickness of subsized specimens should have at least 80 % of the wall thickness. Six specimens shall be removed from each of the following positions: 12 o'clock, 6 o'clock, and 3 o'clock or 9 o'clock, for a total of 18 specimens. For each of these positions, three specimens shall have the V-notch placed in the weld centerline; the other three shall have the V-notch placed in the HAZ as shown in Figure A.2.

A.3.4.2.2 Testing

At least nine valid specimens for each notch location (weld metal or HAZ) shall be tested at or below the minimum design temperature in accordance with the requirements of ASTM E23.

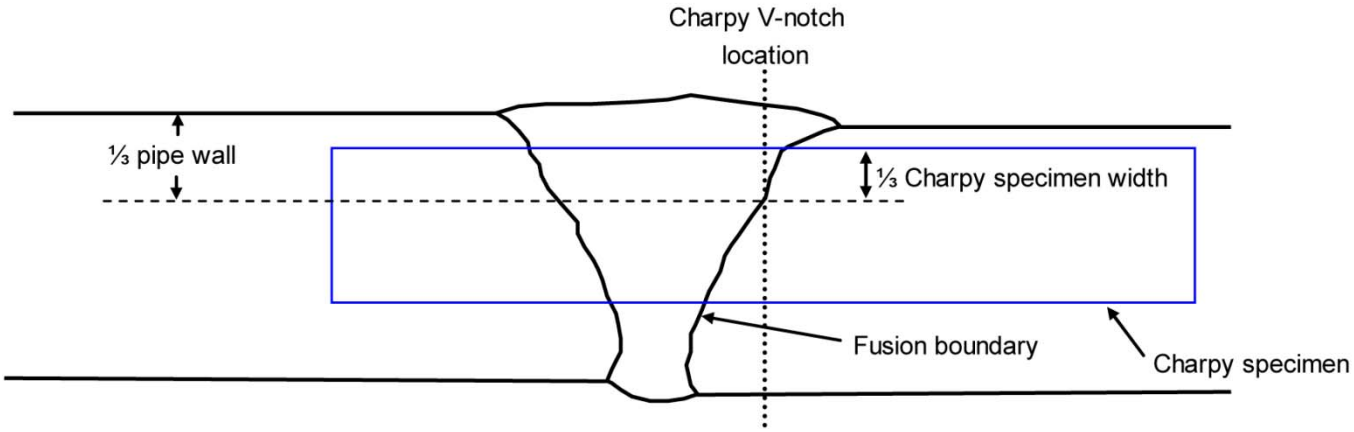


Figure A.2—Charpy Specimen and V-notch Location for HAZ Impact Testing

A.3.4.2.3 Requirements

The impact energy for each notch location (weld metal or HAZ) shall be acceptable when the following criteria are met:

a) the average absorbed energy for each set of three specimens equals or exceeds 30 ft-lb (40 J);

b) the minimum individual absorbed energy for each set of three specimens equals or exceeds 22 ft-lb (30 J);

c) when subsized Charpy specimens are used, the energy requirements, without correction or conversion, as stated in items a) and b) above shall apply.

A.3.4.2.4 Retesting

Retesting shall be permitted when no more than one specimen in each group of nine specimens (weld metal or HAZ) generates an absorbed energy less than 22 ft-lb (30 J), but the average absorbed energy from the set of three specimens that contains the low individual value exceeds 30 ft-lb (40 J). The retest requirements shall be as follows:

a) The three retest specimens shall be extracted from a location as close as possible to the location of the specimen that generated the low result.

b) The absorbed energy of all three retest specimens shall meet or exceed 30 ft-lb (40 J).

If the above retest criteria are satisfied, the Charpy results shall be acceptable. If the above criteria are not satisfied, no further retesting shall be permitted, and the weld shall be rejected.

A.3.4.3 Fracture Toughness Testing

A.3.4.3.1 General

To use the alternative acceptance criteria, the fracture toughness of the weld shall be determined by testing in accordance with BS EN ISO 15653, as supplemented by this annex.

A.3.4.3.2 Specimen Preparation

The preferred test piece ($B \times 2B$) shall be used. As shown in Figure A.3, the specimen should be oriented so that its length is parallel to the pipe axis and its width is in the circumferential direction; thus, the crack tip line is oriented in the through-thickness direction. The specimen thickness (see Figure A.4) should be equal to the pipe thickness less the minimum amount of milling and grinding necessary to produce a specimen with the prescribed rectangular cross-section and surface finish from a curved pipe segment. The weld reinforcement shall be removed. The specimen should be etched after initial preparation to reveal the weld deposit and the geometry of the HAZ. For weld metal tests, the notch and fatigue crack tip should be located at the center of the weld and completely in weld metal (see Figure A.5).

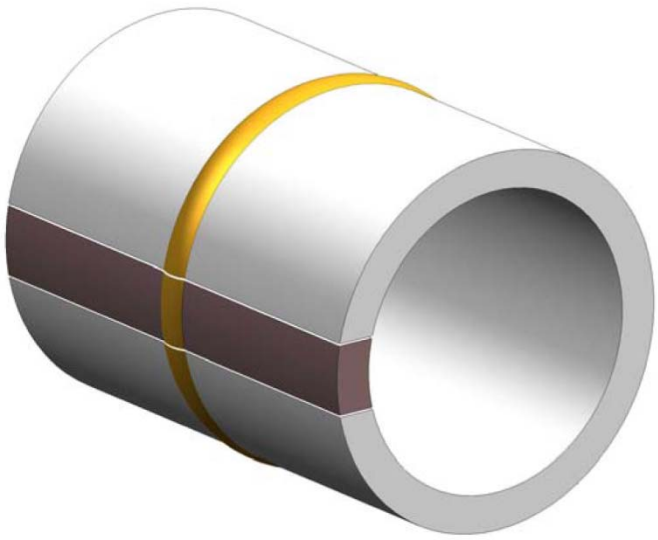


Figure A.3—Orientation of CTOD Test Specimen

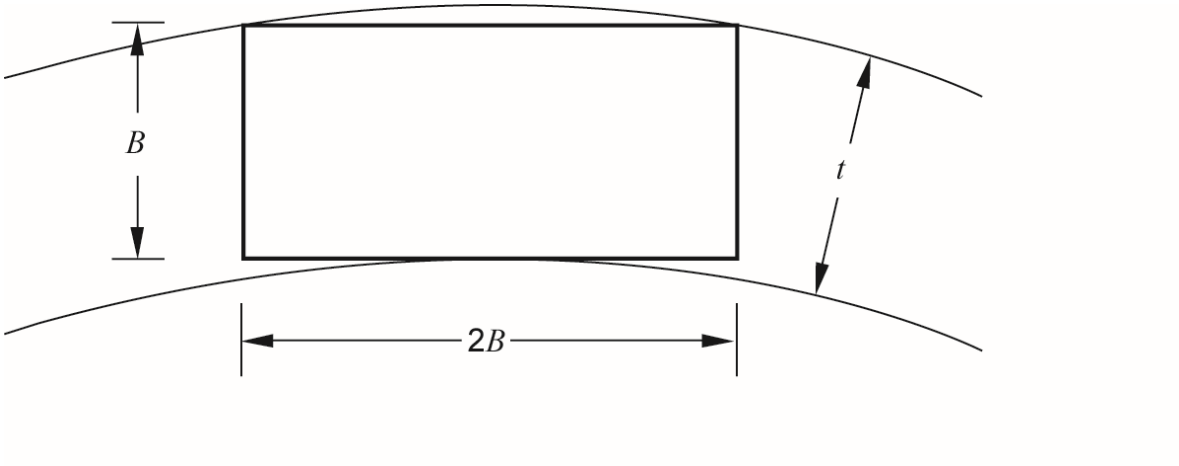


Figure A.4—Machining Objective for CTOD Test Specimen with Respect to Pipe Wall

For the HAZ tests, the fatigue precracks shall be aimed to intersect the largest unrefined coarse grain HAZ regions within the central 70 % of the specimen thickness (see Figure A.6). Each of the three HAZ specimens should be aimed at different coarse grain regions within the central 70 %. If there are fewer than three such regions in the central 70 %, multiple specimens may be aimed at the same region. Multiple specimen sampling of the cap pass coarse grain HAZ should be avoided. No more than one specimen should be devoted to the cap pass HAZ. To identify coarse grain HAZ regions, it may be useful to conduct a microhardness survey to locate the coarsest HAZ regions that have undergone the least amount of tempering by subsequent weld passes.

A.3.4.3.3 CTOD Toughness Testing

For each welding procedure, both the weld metal and the HAZ shall be tested. Each set (weld metal or HAZ) of tests shall consist of at least three valid specimen tests performed at or below the minimum design temperature. The three specimens shall consist of one each from the nominal 12 o'clock, 3 o'clock or 9 o'clock, and 6 o'clock positions on the test weld and should be permanently marked to identify the original position.

After testing, particular attention should be given to the qualification requirements (particularly crack front straightness) of BS EN ISO 15653; these criteria deal with the geometry of the fatigue crack front.

For this annex, the appropriate value of CTOD shall be δc, δu, or δm. When δm applies, care should be taken to measure from the point of first attainment of maximum load. Pop-ins shall be assessed in accordance with BS EN ISO 15653. The test report shall meet the test report requirements of BS EN ISO 15653. Particular attention should be given to reporting the position of the test specimen in the qualification weld and to distinguishing whether the reported CTOD value represents δc, δu, or δm. The test report shall also include a legible copy of the load-displacement record and a record of the appearance of the fracture surfaces; the latter requirement can be satisfied by a clear photograph of one or both fracture surfaces, or by retaining one or both fracture surfaces (properly preserved and identified) for direct observation. Unless otherwise specified by the company, the notch location shall be defined as weld positional per BS EN ISO 15653; that is, no postweld metallography is required.

NOTE δc, δu, and δm are mutually exclusive terms defined in BS EN ISO 15653 that describe the three possible and mutually-exclusive outcomes of the test. The value of δi (CTOD at initiation of stable crack growth) has no significance with regard to this annex and need not be measured.

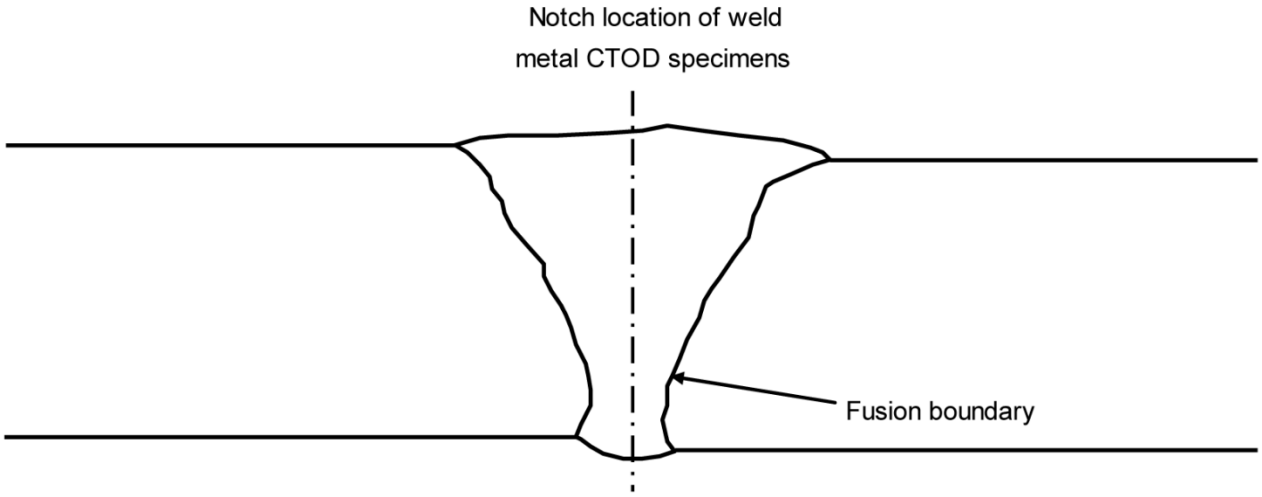


Figure A.5—Location of Notch for Weld Metal Specimen

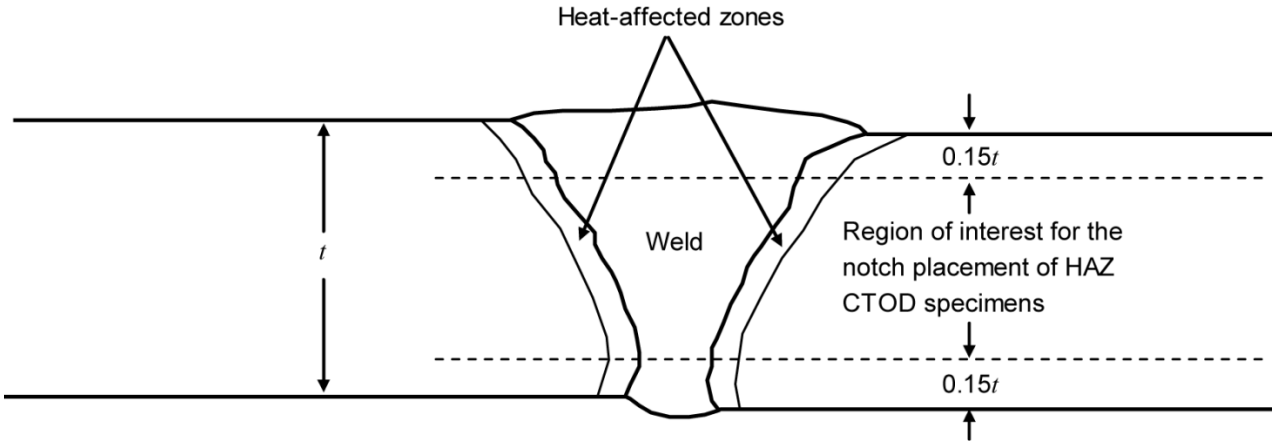


Figure A.6—Location of Notch for Heat-affected Zone Specimen

A.3.4.3.4 Retesting

Retesting shall be permitted on a one-to-one basis only when any of the following conditions exist:

a) specimens are incorrectly machined;

b) the fatigue crack front fails to meet the straightness requirements;

c) substantial weld imperfections adjacent to the crack front are observed upon the fracture of the specimen.

A.3.4.3.5 Requirements

The minimum CTOD value of all six specimens (three weld and three HAZ specimens) shall be greater than 0.002 in. (0.05 mm) to use this annex.

A.4 Qualification of Welders

Welders shall be qualified in accordance with Section 6. For mechanized welding, each operator shall be qualified in accordance with 12.7.

A.5 Inspection and Acceptable Limits

A.5.1 Planar Imperfections

A.5.1.1 General

The length and height of an imperfection, and its depth below the surface, shall be established by appropriate nondestructive inspection techniques or otherwise justified before a decision to accept or reject can be made. Conventional radiography, as described in 11.1, is adequate for measuring imperfection length but is insufficient for determining height, particularly for planar imperfections such as cracks, lack of fusion, undercutting, and some types of lack of penetration. The use of ultrasonic techniques, radiographic techniques that employ densitometers or comparative visual reference standards, acoustic imaging, inherent imperfection-size limitations due to weld-pass geometry, or any other technique for determining imperfection height is acceptable, provided the technique's accuracy has been established (e.g., see 11.4.3) and any potential inaccuracy is included in the measurement; that is, the determination of imperfection height shall be conservative. The use of conventional radiography (see 11.1) to identify imperfections that require height measurement by other means is acceptable.

A.5.1.2 Structure of the Procedures to Determine the Maximum Acceptable Imperfection Size

The procedures to determine the maximum acceptable planar imperfection size are given in three options. Option 1 is a simplified approach in graphical format. It relies on theoretically sound and experimentally validated plastic collapse criteria and has been modified by the Option 2 approach when appropriate. Option 2 is in the form of a failure assessment diagram (FAD). The FAD format allows the simultaneous consideration of brittle fracture, plastic collapse, and the interaction between those two failure modes (elastic-plastic fracture). Options 1 and 2 are limited to pipelines with limited fatigue loads as specified in A.2.2. Option 3 permits the use of validated fitness-for-purpose procedures when the cyclic loading exceeds the spectrum requirements of Options 1 and 2.

The Option 1 procedures are limited to CTOD toughness equal to or greater than 0.004 in. (0.10 mm). The Options 2 and 3 procedures may be applied at any CTOD toughness level greater than the minimum required value of 0.002 in. (0.05 mm).

The basis of the Options 1 and 2 procedures places no limit on pipe diameter or diameter-to-wall thickness ratio (D/t ratio). Theoretical validation has shown that the procedures are valid for $D/t \geq 10$.

Line pipes with ultrahigh Y/T ratio ($Y/T > 0.95$) are often associated with low uniform strain (engineering strain at ultimate tensile stress) and low ductility. Additional testing and validation may be necessary to use the alternative acceptance criteria in this annex.

A.5.1.3 Determination of Acceptable Imperfection Size by Option 1

A.5.1.3.1 General

Two sets of acceptance criteria are given, depending on the CTOD toughness value.

When the CTOD toughness is equal to or greater than 0.010 in. (0.25 mm), the maximum acceptable imperfection size is given in Figure A.7 at various load levels (P_r). If the load level is not given in Figure A.7, the maximum acceptable imperfection size can be obtained by interpolating the adjacent curves or by taking the value of the next higher load level.

When the CTOD toughness is equal to or greater than 0.004 in. (0.10 mm) and less than 0.010 in. (0.25 mm), the maximum acceptable imperfection size shall be as given in Figure A.8.

The acceptable imperfection size may be more limiting than that from the Option 2 procedure as the limits in Figure A.7 and Figure A.8 were calibrated to a CTOD toughness of 0.010 in. (0.25 mm) and 0.004 in. (0.10 mm), respectively.

The total imperfection length shall be no greater than 12.5 % of the pipe circumference. The maximum imperfection height shall be no greater than 50 % of the pipe wall thickness.

The allowable height of the buried imperfections is treated the same as the allowable height of the surface-breaking imperfections.

The built-in conservatism in the acceptable imperfection size can accommodate a certain amount of undersizing of imperfection height without negatively impacting weld integrity. The assumed height uncertainty built into the conservatism is the lesser of 0.060 in. (1.5 mm) and 8 % of pipe wall thickness.

The allowable imperfection height shall be reduced by the difference between the height undersizing error of the qualified inspection procedure and the assumed height uncertainty, if the height undersizing error is greater than the assumed height uncertainty. No change should be made to the allowable imperfection height, if the height undersizing error is less than the assumed height uncertainty. [16]

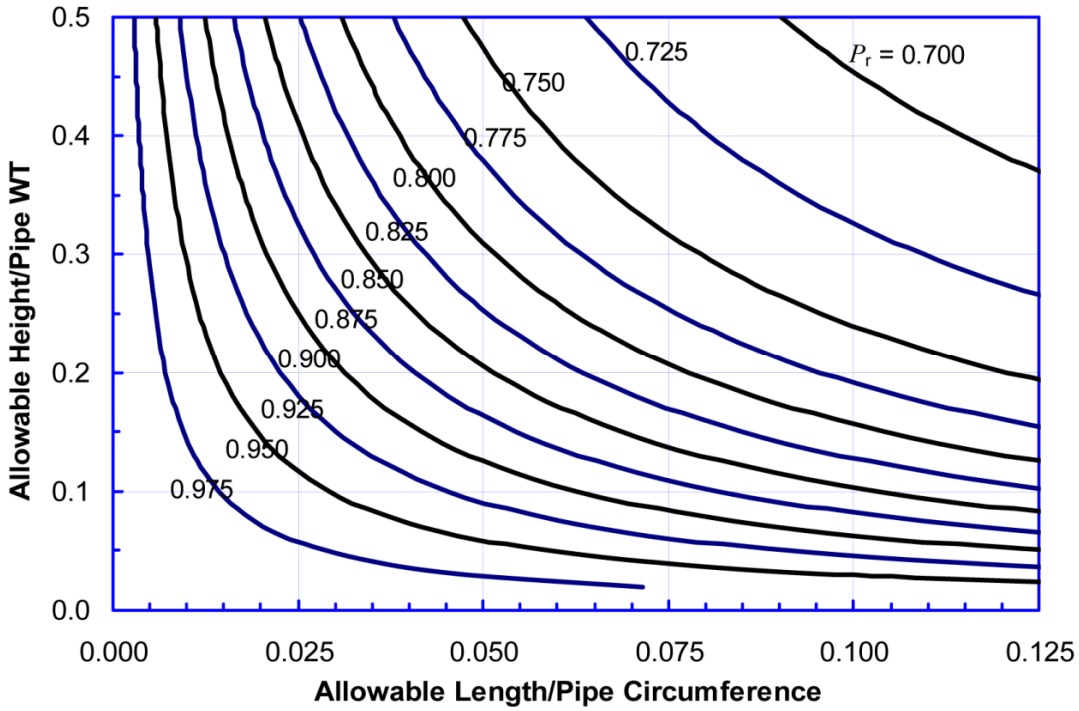


Figure A.7—Option 1 Imperfection Limits for CTOD ≥ 0.010 in. (0.25 mm)

[16] See example problem in A.5.1.3.3.

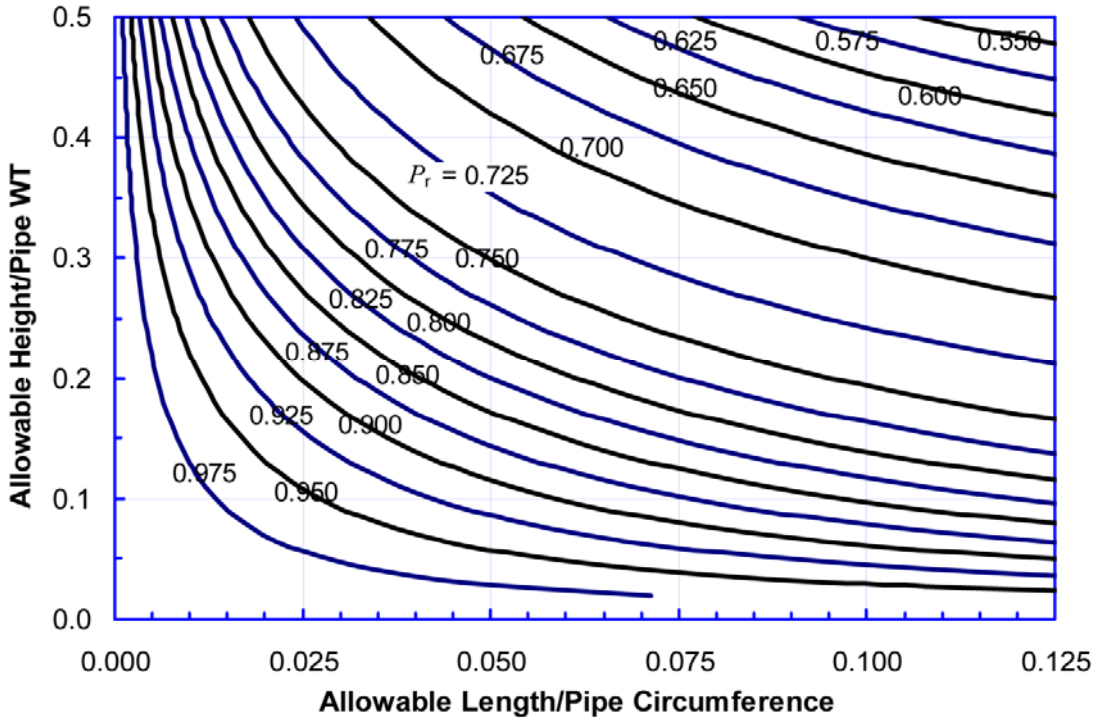


Figure A.8—Option 1 Imperfection Limits for 0.004 in. (0.10 mm) ≤ CTOD < 0.010 in. (0.25 mm)

A.5.1.3.2 Computation of the Load Level (P_r)

The material's flow stress shall be calculated to obtain the load level P_r. The flow stress shall be the averaged value of the SMYS and SMTS. Alternatively, the flow stress of API 5L, Grades X52 to X80, may be conservatively estimated by Equation (A.2).

$$\sigma_f = \sigma_y \left[1 + \left(\frac{21.75}{\sigma_y} \right)^{2.30} \right] \tag{A.2}$$

where the pipe grade, σ_y, is in the unit of ksi.

The load level, P_r, is given in Equation (A.3):

$$P_r = \frac{\sigma_a}{\sigma_f} \tag{A.3}$$

A.5.1.3.3 Example of Option 1 Application

The following is an example for performing an ECA with the Option 1 methodology. A 24-in. OD pipeline with a specified wall thickness (t) of 0.50 in. with the grade of API 5L X70 is considered. After reviewing A.1 and A.2 of this annex and consulting with the project's engineer (as required), it is understood that the maximum axial design stress is 61.5 ksi. Weld test data conducted per the requirements of the annex indicate that the minimum CTOD value is 0.011 in. These parameters are summarized as follows:

Pipe OD: 24 in.

Pipe t: 0.500 in.

SMYS: 70 ksi

SMTS: 82 ksi

CTOD: 0.011 in.

σ_a: 61.5 ksi

Allowance for inspection: 0.050 in.

The following steps detail the ECA computation.

Step 1: Determine Flow Stress

Determine the flow stress with Equation (A.2) by substituting the 70 ksi for σ_y [Equation (A.4)]:

$$\sigma_f = 70\left[1+\left(\frac{21.75}{70}\right)^{2.30}\right] = 74.76 \quad \text{(A.4)}$$

Note that for this example, the flow stress can alternatively be determined as the averaged value of SMYS and SMTS, or in this case, 76 ksi, a value very close to the value derived using Equation (A.2).

Step 2: Determine Applied Load Level

The load level P_r is now calculated by inserting the aforementioned values for σ_a and σ_f [Equation (A.5)]:

$$P_r = \frac{\sigma_a}{\sigma_f} = \frac{61.5}{74.76} = 0.823 \quad \text{(A.5)}$$

Step 3: Determine Initial Allowable Imperfection Size

Figure A.7 is utilized for determining the initial allowable imperfection size (CTOD ≥ 0.010 in. or 0.25 mm). The curve of P_r = 0.825 in the figure is now used for the interpolations. The allowable imperfection size is tabulated in Table A.3 and shown in Figure A.9.

The allowable height quantities, shown in the second column of Table A.3, are derived by multiplying the allowable height/pipe wall thickness value by the t that in this example is 0.500 in. Similarly, the allowable length is calculated by multiplying the allowable length/pipe circumference quantity by the pipe circumference (π × OD) or 3.14 × 24 in.

Table A.3—Initial Allowable Imperfection Size for P_r = 0.825

Allowable Height/Pipe Wall Thickness	Allowable Height in.	Allowable Length/Pipe Circumference	Allowable Length in.
0.5	0.25	0.025	1.9
0.4	0.2	0.032	2.4
0.3	0.15	0.042	3.2
0.2	0.1	0.063	4.8
0.1	0.05	0.128	9.7

Step 4: Determine Height Adjustment

Assumed height uncertainty = lesser of 8 % t and 0.060 in. = 0.040 in. (1.02 mm).

Allowance for inspection (i.e., inspection error) = 0.050 in. (1.27 mm).

Imperfect height adjustment = allowance for inspection – assumed height uncertainty

= 0.050 – 0.040

= 0.010 in. (0.25 mm).

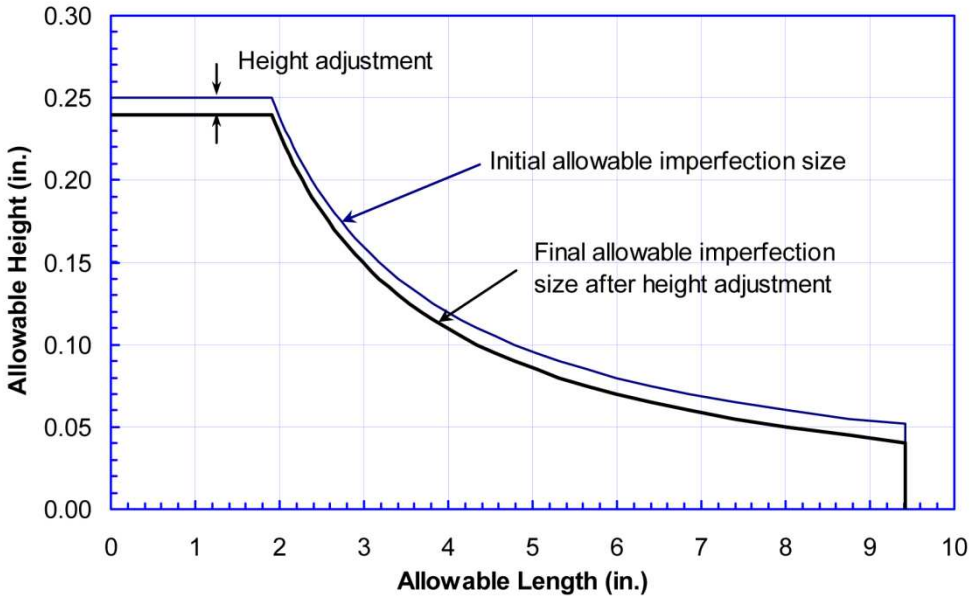


Figure A.9—Allowable Imperfection Size Curves Before and After Height Adjustment

Step 5: Produce Final Acceptance Table

The results of the ECA should be tabulated in a user-friendly format. Table A.4 suggests an operator-friendly format for this ECA example. However, a project with a heavier wall thickness may have more rows in a similar table. [17]

Table A.4—Example Acceptance Table

Allowable Imperfection Height in.	**Allowable Imperfection Length** in.
0 to 0.05	8.0
0.05 to 0.15	3.0
0.15 to 0.24	1.9
>0.24	0.0

[17] Further adjustments may be desirable, see Step 8) of A.5.1.4.2.

A.5.1.4 Determination of Acceptable Imperfection Size by Option 2

A.5.1.4.1 Background

The underlining Option 2 procedure is the FAD. There are three key components in the assessment in FAD format (see Figure A.10):

1) failure assessment curve (FAC);

2) stress or load ratio, S_r or L_r; and

3) toughness ratio, K_r.

The FAC is a locus that defines the critical states in terms of the stress and toughness ratios. The stress ratio defines the likelihood of plastic collapse. The toughness ratio is the ratio of applied crack driving force over the material's fracture toughness. It defines the likelihood of brittle fracture.

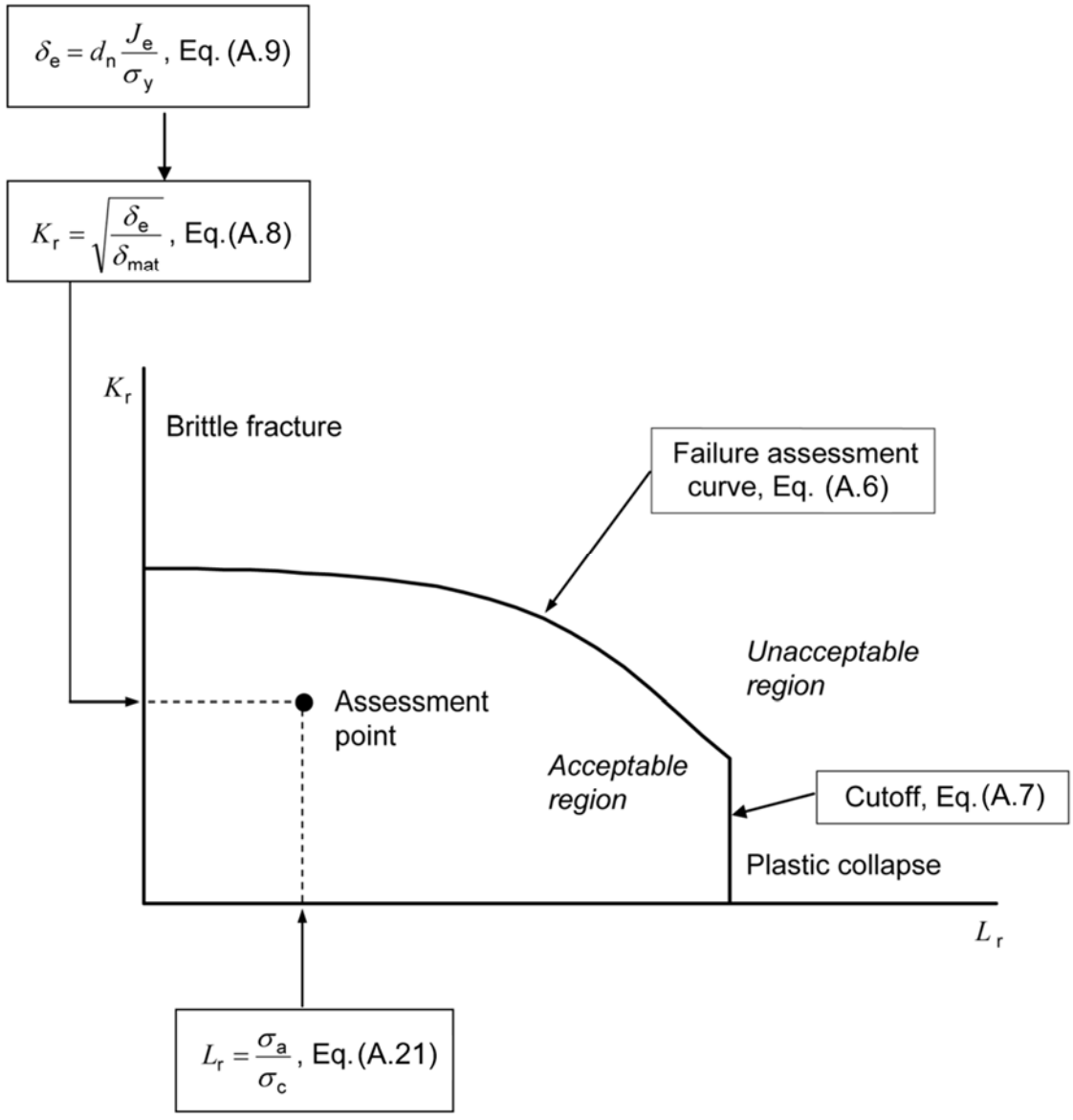


Figure A.10—Schematic Overview of the Option 2 Procedure

The FAD approach is computationally complex. Proficiency and understanding of fracture mechanics is necessary to ensure the procedure is applied correctly. A validated computer program should greatly simplify the computation.

A.5.1.4.2 Determination of Critical Imperfection Size

The critical imperfection size can be computed iteratively using equations provided in A.5.1.4.3. The following steps may be followed.

1) Select an imperfection size as a start point. A reasonable start point is an imperfection with the maximum allowed height, η = 0.5, and a small imperfection length that represents the smallest imperfection length that the selected inspection methods can confidently detect.

2) Determine the assessment point in the FAD format in accordance with A.5.1.4.3.

3) If the assessment point falls inside the safe region, increase the imperfection length and repeat Step 2).

4) If the assessment point falls outside the safe region, decrease the imperfection length and repeat Step 2).

5) If the assessment point falls on the FAC:

   a) this represents a critical state with the combination of load, material property, and imperfection size. Make a note of the imperfection height and length;

   b) reduce the imperfection height by a small increment, such as $\Delta\eta$ = 0.05. Start from the imperfection length determined in item a) and repeat Step 2);

6) Make a table of critical imperfection height and length.

7) Apply a safety factor of 1.5 on the imperfection length to produce a draft table of the allowable imperfection height versus imperfection length.

8) Make necessary adjustment to the draft table to ensure detectability of the selected inspection methods [18] and sound welding practice. [19] Produce the final table of the allowable imperfection height versus imperfection length.

The total imperfection length shall be no greater than 12.5 % of the pipe circumference. The maximum imperfection height shall be no greater than 50 % of the pipe wall thickness.

The allowable height of the buried imperfections is treated the same as the allowable height of the surface-breaking imperfections.

The built-in conservatism in the acceptable imperfection size can accommodate a certain amount of undersizing of imperfection height without negatively impacting weld integrity. The assumed height uncertainty built into the conservatism is the lesser of 0.060 in. (1.5 mm) and 8 % of pipe wall thickness.

The allowable imperfection height shall be reduced by the difference between the height undersizing error of the qualified inspection procedure and the assumed height uncertainty if the height undersizing error is greater than the assumed height uncertainty. The reduction shall be done after applying the maximum imperfection height (i.e., 50 % of pipe wall thickness (see A.5.1.3.3). No change should be made to the allowable imperfection height if the height undersizing error is less than the assumed height uncertainty.

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[18] It is necessary to ensure that the smallest imperfection height and length could be reliably detected by the selected inspection method.

[19] For thick-walled pipes, the maximum allowable height of the 50 % wall thickness could be a large value. The maximum allowable height may be reduced if such a large value is judged unnecessary by sound welding practice.

A.5.1.4.3 Determination of the Key Components in the FAD Procedure

Failure Assessment Curve (FAC)

The FAC is given as Equation (A.6):

$$K_r = f\left(L_r\right) = \left(1 - 0.14L_r^{\,2}\right)\left[0.3 + 0.7\exp\left(-0.65L_r^{\,6}\right)\right] \tag{A.6}$$

The cut-off of the FAC on the L_r axis is per Equation (A.7):

$$L_r^{cutoff} = \frac{\sigma_f}{\sigma_y} \tag{A.7}$$

where the flow stress σ_f is the averaged value of SMYS and SMTS, or alternatively determined by Equation (A.2).

Assessment Point, Toughness Ratio K_r

The toughness ratio K_r is given as Equation (A.8):

$$K_r = \sqrt{\frac{\delta_e}{\delta_{mat}}} \tag{A.8}$$

where δ_{mat} is the CTOD toughness of the material. The elastic component of the CTOD driving force, δ_e, may be computed as Equation (A.9):

$$\delta_e = d_n \frac{J_e}{\sigma_y} \tag{A.9}$$

The J to CTOD conversion factor, d_n, is estimated as Equation (A.10):

$$d_n = 3.69\left(\frac{1}{n}\right)^2 - 3.19\left(\frac{1}{n}\right) + 0.882 \tag{A.10}$$

where n is the strain hardening exponent in the following stress (σ)-strain (ε) relation in Equation (A.11):

$$\varepsilon = \frac{\sigma}{E} + \left(0.005 - \frac{\sigma_y}{E}\right)\left(\frac{\sigma}{\sigma_y}\right) \tag{A.11}$$

where E is Young's modulus.

The strain hardening exponent may be estimated from Y/T ratio [Equation (A.12)]:

$$n = \frac{ln\left(\varepsilon_t / 0.005\right)}{ln\left\{1/\left(Y/T\right)\right\}} \tag{A.12}$$

For ferritic material of API 5L, Grades X52 to X80, the Y/T ratio may be estimated as Equation (A.13):

$$Y/T = \frac{1}{1+2\left(\frac{21.75}{\sigma_y}\right)^{2.30}} \tag{A.13}$$

and the uniform strain is estimated as Equation (A.14):

$$\varepsilon_t = -0.00175\sigma_y + 0.22 \tag{A.14}$$

The pipe grade, σ_y, is in the unit of ksi in Equation (A.13) and Equation (A.14).

The elastic J_e integral is given as Equation (A.15):

$$J_e = \frac{K_1^{\,2}}{E/\left(1-v^2\right)} \tag{A.15}$$

and Equation (A.16):

$$K_1 = \sigma_a\sqrt{\pi a}F_b \tag{A.16}$$

The parameter F_b is a function of pipe diameter ratio, α, and relative imperfection length, β, and relative imperfection height, η [Equation (A.17)]:

$$F_b\left(\alpha,\beta,\eta\right) = \begin{cases} F_{b0}\left(\alpha,\beta,\eta\right) & \eta \geq 0.1 \text{and } \beta \leq \dfrac{80}{\pi}\dfrac{\eta}{\alpha} \\ F_{b0}\left(\alpha,\beta=\dfrac{80}{\pi}\dfrac{\eta}{\alpha},\eta\right) & \eta \geq 0.1 \text{and } \beta \leq \dfrac{80}{\pi}\dfrac{\eta}{\alpha} \\ F_{b0}\left(\alpha,\beta=\dfrac{80}{\pi}\dfrac{\eta}{\alpha},0.1\right) & \eta \geq 0.1 \end{cases} \tag{A.17}$$

Where

$$F_{b0}\left(\alpha,\beta,\eta\right) = \left(1.09 + 2.31\alpha^{0.791}\beta^{0.906}\eta^{0.983} + \frac{m_1}{\alpha\beta} + \alpha^{0.806}\beta m_2\right) \tag{A.18}$$

$$m_1 = -0.00985 - 0.163\eta - 0.345\eta^2 \tag{A.19}$$

$$m_2 = -0.00416 - 2.18\eta - 0.155\eta^2 \tag{A.20}$$

Assessment Point, Stress Ratio L_r

The stress ratio L_r is given as Equation (A.21):

$$L_r = \frac{\sigma_a}{\sigma_c} \tag{A.21}$$

The plastic collapse stress σ_c is given as Equation (A.22) and Equation (A.23):

$$\sigma_c = \left[\frac{\pi}{4} + 385\left(0.05 - \eta\beta\right)^{2.5}\right]\left[\cos\left(\frac{\eta\beta\pi}{2}\right) - \frac{\eta\sin\left(\beta\pi\right)}{2}\right]\sigma_y \quad \text{if } \eta\beta < 0.05 \tag{A.22}$$

$$\sigma_c = \frac{\pi}{4}\left[\cos\left(\frac{\eta\beta\pi}{2}\right) - \frac{\eta\sin\left(\beta\pi\right)}{2}\right]\sigma_y \quad \text{if } \eta\beta \geq 0.05 \tag{A.23}$$

NOTE Unit for π is in radians.

A.5.1.5 Determination of Acceptable Imperfection Size by Option 3

A.5.1.5.1 General

In most offshore pipelines and flowlines, cyclic loading during construction and operation is present. The Option 3 procedures are permitted only when the fatigue spectrum severity is greater than 5×10^6.

Subject to company approval, validated fitness-for-purpose procedures and qualification tests may be used to develop imperfection acceptance criteria. One of the most widely accepted procedures is BS 7910. The procedures shall be applied by well-qualified analysts/engineers who have demonstrated command of the principles of fracture mechanics, pipeline welding, and NDT. Any selected procedure shall be taken as a whole in developing the acceptance criteria with appropriate considerations of safety factors. It should be recognized that the basic assumptions of various public-accessible assessment procedures and qualification tests may be different from those of Options 1 and 2. Mixing parts of different procedures is discouraged.

A.5.1.5.2 Fatigue Flaw Growth

Appropriate fatigue analysis shall be conducted to determine the starting flaw acceptance criteria. Various public-accessible procedures and software are available to determine the flaw growth (e.g., assessment for fatigue per BS 7910). Static fracture resistance shall be checked for all peak loads during the entire fatigue loading spectrum. Available software programs may be used by skilled practitioners to conduct this fatigue analysis and check the static failure conditions during the entire application of the cyclic loads.

The allowable flaw size from Option 1 may be used as the starting flaw sizes for both buried and surface-breaking flaws. If the critical flaw size is reached or failure from static peak loads occurs prior to the end of the service life (with the appropriate design or safety factor), the starting flaw sizes need to be reduced. Care should be taken to select the appropriate flaw growth curves (da/dN curves) for the type of service. BS 7910 provides guidance related to fatigue crack growth and selection of these curves, and the company may provide supplemental information used to generate flaw growth curves for different product conditions inside the pipe. For small D/t ratio pipes, through-thickness stress is not uniform. Analyses from multiple initial flaw locations are necessary.

A.5.1.5.3 Inspection Error and Safety Factor on Allowable Imperfect Size

The allowable flaw height shall be reduced by the inspection error extracted from NDT qualification results of qualified inspection system/procedure/operator for the specific project or project with similar material and welding procedure.

A.5.1.6 Transverse Planar Imperfections

Transverse planar imperfections shall be repaired or removed. The height of imperfections that are indicative of stacked weld bead starts and stops shall not exceed the lesser of 1/4 in. (6.4 mm) or 50 % of the wall thickness.

A.5.2 Acceptable Limits of Volumetric Imperfections

Buried volumetric imperfections, such as slag or porosity, contained in material with high fracture toughness are much less likely to cause failure than planar imperfections. These imperfections may be treated and evaluated as planar imperfections or by the simplified method of Table A.5. Surface-breaking imperfections, and buried imperfections that are recategorized as surface-breaking by the imperfection interaction rules, shall be treated and evaluated as planar imperfections.

NOTE The minimum CTOD toughness and Charpy impact energy requirements are applicable regardless of how the imperfections are evaluated.

Table A.5—Acceptance Limits for Buried Volumetric Imperfections

Imperfection Type	Height or Width	Length
Porosity	Lesser of $t/4$ or 0.25 in. (6.4 mm)	Less of $t/4$ or 0.25 in. (6.4 mm)
Slag	Lesser of $t/4$ or 0.25 in. (6.4 mm)	$4t$

A.5.3 Arc Burns

Arc burns may occur on the internal or external surface of the pipe as a result of inadvertent arc strikes or improper grounding. They generally appear as a pit or cavity visible to the eye or as a dense area on the radiograph. The cavity may be surrounded by a hard HAZ that may be of lower toughness than the base material or the weld deposit.

The acceptance limits for unrepaired arc burns shall be as given in Table A.6 and are based on the premise that the HAZ has zero toughness but that any planar imperfection originating within the HAZ is blunted at the edge of the zone.

NOTE Substantial data indicate that the total depth of the arc burn, including the HAZ, are less than half the width of the burn.

Table A.6—Acceptable Limits for Unrepaired Arc Burns

Measured Dimension	Acceptance Limit
Width	Lesser of t or $5/16$ in. (7.9 mm)
Length (any direction)	Lesser of t or $5/16$ in. (7.9 mm)
Depth (to bottom of crater)	$1/16$ in. (1.6 mm)

Arc burns that contain cracks visible to the eye or on conventional radiographs are not covered by this annex and shall be repaired or removed.

A.5.4 Imperfection Interaction

If adjacent imperfections are close enough, they may behave as single larger imperfections. Figure A.11 shall be used to determine whether interaction exists. If it does, the effective imperfection sizes shown in Figure A.11 shall be computed and the acceptability of the effective imperfection shall be evaluated by the applicable acceptance criteria. If a repair is indicated, any interacting imperfections shall be repaired in accordance with A.7.

A.6 Record

The type, location, and dimensions of all imperfections rejected in accordance with this annex shall be recorded on suitable forms. This record shall be filed with the radiographs or other records of nondestructive tests of the pipeline.

A.7 Repairs

A.7.1 Repairs and Acceptance of Welds

Any imperfections that are not acceptable under the provisions of this annex shall be repaired in accordance with Section 10 or removed.

If a weld is repaired, the total accumulative length of all repair areas shall be no more than 30 % of the pipe circumference or 30 in. (762 mm), whichever is less. The repair areas shall be radiographic tested in accordance with 11.1 or ultrasonic tested in accordance with 11.4. The repair areas shall be considered acceptable when the repaired areas meet the standards of acceptability of Section 9, more stringent acceptance criteria specified by the company, or acceptance criteria of A.7.2.

A.7.2 Repair and Acceptance of Welds under Special Circumstances in Option 3

When the imperfection acceptance criteria of Option 3 are more restrictive (smaller) than the acceptance criteria of Section 9, an alternative acceptance criterion shall be established for the repair welds with appropriate qualification testing in accordance with the procedures of A.5.1.5.1.

A.8 Nomenclature [20]

a imperfection height (in. or mm)

c imperfection half length (in. or mm)

D pipe outer diameter (in. or mm)

d_n J integral to CTOD conversion factor (unitless)

D Young's modulus (ksi or MPa)

J_e elastic part of J integral (ksi in. or MPa mm)

K_I stress intensity factor [ksi (in.)$^{1/2}$ or MPa (mm)$^{1/2}$]

K_r toughness ratio in FAD format (unitless)

L_r stress ratio in FAD format (unitless)

L_r^{cutoff} cutoff stress ratio in FAD format (unitless)

n strain hardening exponent (unitless)

P_r normalized applied stress or load level (unitless)

α ratio of pipe diameter to wall thickness, $\alpha = D/t$ (unitless)

[20] The units shown here are for illustrative purposes. It is necessary to ensure consistent units are used for all computations. Some equations, such as Equation (A.3), Equation (A.11), Equation (A.12), and Equation (A.13), shall use specified units.

β ration of imperfection length to pipe circumference, $\beta = 2c/\pi D$ (unitless)

δ_e elastic part of CTOD (in. or mm)

δ_{mat} CTOD toughness (in. or mm)

t specified pipe wall thickness (in. or mm)

η ratio of imperfection height to pipe wall thickness, $\eta = a/t$ (unitless)

ν Poisson's ratio (unitless)

σ_a maximum axial design stress (ksi or MPa)

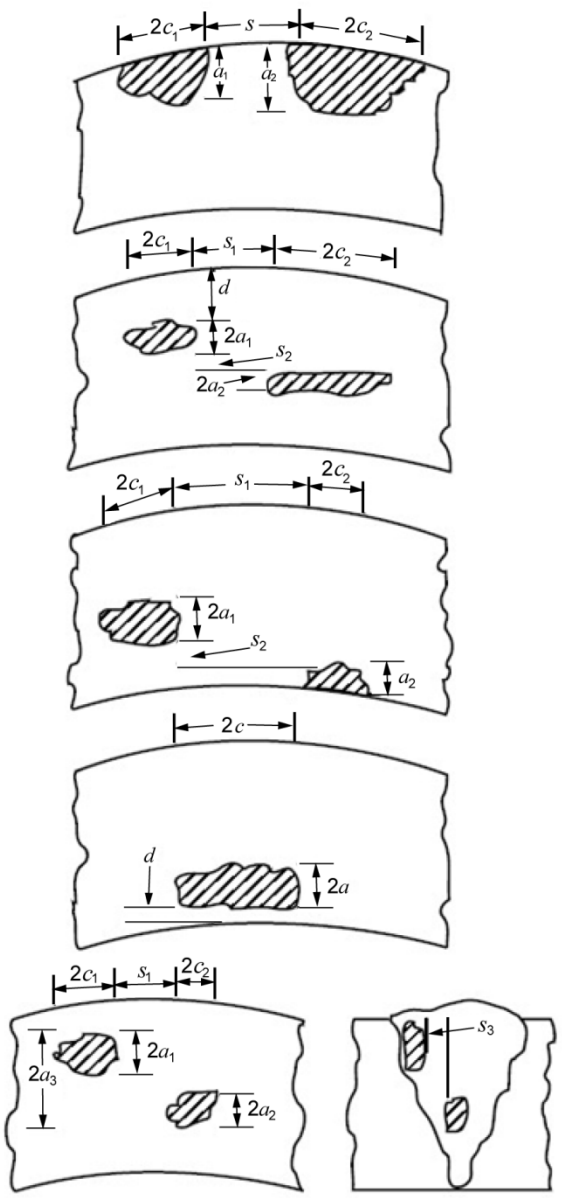
σ_c plastic collapse stress (ksi or MPa)

σ_f flow stress of the pipe material (ksi or MPa)

σ_t, T ultimate tensile strength of the pipe material (ksi or MPa)

σ_y, Y specified minimum yield strength of the pipe material, or SMYS, (ksi or MPa)

ε_t uniform strain (unitless)



	Interaction exists if	If interaction exists, effective imperfection size is
Case 1	$s < 2c_1$	$a_e =$ larger of a_1 and a_2
	$(c_1 < c_2)$	$2c_e = 2c_1 + s + 2c_2$
Case 2	$s_1 < 2c_1$ and $s_2 < a_1 + a_2$ $(c_1 < c_2)$	$2a_e = 2a_1 + s_2 + 2a_2$ $2c_e = 2c_1 + s_1 + 2c_2$
Case 3	$s_1 < 2c_1$ and $s_2 < a_1 + a_2$ $(c_1 < c_2)$	$a_e = 2a_1 + s_2 + a_2$ $2c_e = 2c_1 + s_1 + 2c_2$
Case 4	$d < a$	$a_e = d + 2a$ $2c_e = 2c$
Case 5	$s_1 <$ smaller of $2c_1$ or $2c_2$ $s_3 <$ smaller of $2a_1$ or $2a_2$	$2a_e = 2a_3$ $2c_e = 2c_1 + s_1 + 2c_2$

Figure A.11—Criteria for Evaluation of Imperfection Interaction

Annex B
(normative)

In-service Welding

B.1 General

This annex covers recommended welding practices for making repairs to or installing appurtenances on pipelines and piping systems that are in service. For the purposes of this annex, in-service pipelines and piping systems are defined as those that contain crude petroleum, petroleum products, or fuel gases that may be pressurized and/or flowing. The principles in this annex are equally applicable to pipelines containing air, water, and other products not listed in Section 1. In-service welds are defined as those that fuse directly into the wall of an in-service pipeline or piping system. This annex does not cover pipelines and piping systems that have been fully isolated and decommissioned or that have not been commissioned.

An in-service pipeline or piping system that operates under such conditions that do not increase the weld cooling rate or increase the risk of hydrogen cracking when compared to the Section 5 procedure qualification conditions should be welded in accordance with that Section 5 welding procedure or Annex B.

There are two primary concerns with welding onto in-service pipelines. The first concern is to avoid "burn-through," (defined in 3.1.6), where the welding arc causes the pipe wall to be breached. The second concern is for hydrogen cracking, since welds made in service cool at an accelerated rate as the result of the flowing contents' ability to remove heat from the pipe wall.

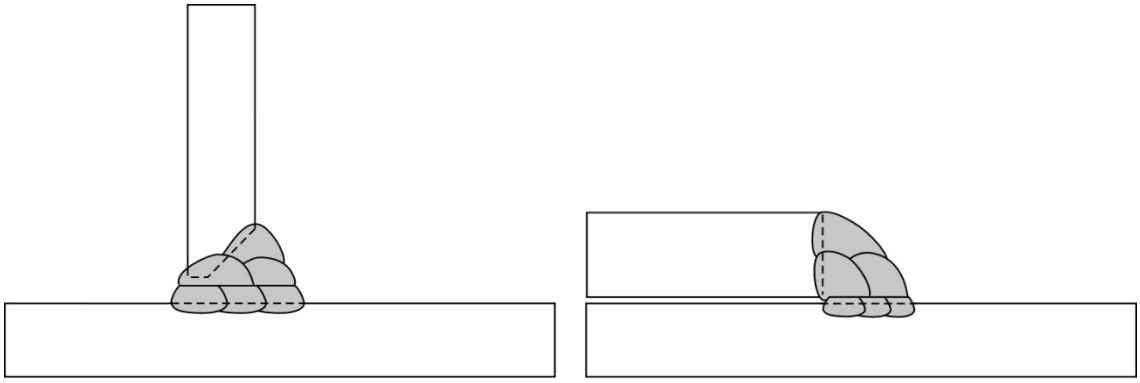
Burn-through is unlikely when installing an appurtenance if the wall thickness is 0.250 in. (6.4 mm) or greater, provided that low-hydrogen electrodes (EXX18 type) and normal welding practices are used. Welding onto thinner wall in-service pipelines is possible and considered routine by many companies; however, special precautions, such as the use of a procedure that limits heat input, are often specified. Burn-through becomes more likely when welding directly onto the pipe, which may occur when depositing the buttering layers of a temper bead deposition sequence or when performing weld deposition repair. Weld deposition repair, or repair by direct deposition of weld metal, involves restoring wall thickness by depositing weld metal directly to the area of wall loss.

For hydrogen cracking to occur, three conditions need to be satisfied simultaneously. These conditions are: hydrogen in the weld, the development of a crack-susceptible weld microstructure, and tensile stress acting on the weld. To prevent hydrogen cracking, at least one of the three conditions necessary for its occurrence need to be minimized or eliminated. For welds made onto in-service pipelines, success has been achieved using low-hydrogen electrodes or a low-hydrogen process and, since low hydrogen levels cannot always be guaranteed, using procedures that minimize the formation of crack-susceptible microstructures. The most common procedures use a sufficiently high heat input level to overcome the effect of the flowing contents. Several heat input prediction methods have been developed, including thermal analysis computer models.[21] While these or other proven methods are useful in predicting the heat input required for a given in-service welding application, they should not be considered a substitute for procedure qualification (see B.2). Preheating, where practicable, and/or the use of a temper bead deposition sequence, can also reduce the risk of hydrogen cracking. For some pipeline operating conditions, the ability of the flowing contents to remove heat from the pipe wall tends to make the effective use of preheating difficult. Examples of typical temper bead deposition sequences are shown in Figure B.1. To minimize the stress acting on the weld, attention should also be given to proper fit-up to minimize the stress concentration at the root of the weld.

The successful application of in-service welding needs to achieve a balance between safety and the prevention of unsatisfactory material properties. For example, if the pipe wall is thin [i.e., less than 0.250 in.

[21] "Development of Simplified Weld Cooling Rate Models for In-service Gas Pipelines," PRCI Catalog No. L51660 or "Thermal Analysis Model for Hot-tap Welding Version 4.2," PRCI Catalog No. L51837.

(6.4 mm)], it may be necessary to limit heat input to minimize the risk of burn-through; however, a low heat input level may be insufficient to overcome the ability of the contents to remove heat from the pipe wall, resulting in excessive weld cooling rates and a subsequent risk of hydrogen cracking. Thus, a compromise needs to be reached. When the maximum allowable heat input to avoid burn-through is insufficient to provide adequate protection against hydrogen cracking, alternative precautions (e.g., a temper bead deposition sequence) need to be used.



NOTES:
1. A layer of weld metal buttering is first deposited using stringer beads.
2. Higher heat input levels are used for subsequent passes, which refine and temper the HAZ of the first layer.

Figure B.1—Examples of Typical Temper Bead Deposition Sequences

The majority of this annex pertains to preventing hydrogen cracking in in-service welds. If the pipe wall thickness is less than 0.250 in. (6.4 mm), the risk of burn-through should be considered. The previously mentioned thermal analysis computer models [19] or another proven method should be used to determine heat input limits for these applications. Additional consideration should also be given for welding onto in-service pipelines and piping systems that contain products that become explosively unstable upon the application of heat or that contain products that will affect the pipe material by rendering it susceptible to ignition, stress corrosion cracking, or embrittlement. Additional guidance can be found in API 2201.

The requirements in the main body of this document should be applied to in-service welds that contact the carrier pipe, except for the alternative/additional requirements specified in this annex. For in-service welding, where discrepancies exist between this annex and the main body of this document, the annex should govern.

B.2 Qualification of In-service Welding Procedures

B.2.1 General

In addition to the applicable requirements in 5.3 for welding procedure specifications, the alternative/additional requirements specified in this annex should be applied to in-service welds.

B.2.2 Welding Procedure Specification

B.2.2.1 Specification Information

B.2.2.1.1 Materials

For in-service welds, the carbon equivalent [22] of the materials to which the procedure applies should be identified in addition to SMYS. Carbon equivalent levels may be grouped.

B.2.2.1.2 Pipeline Operating Conditions

For in-service welds, the pipeline operating conditions (pipe contents, flow rate, etc.) for which the procedure applies should be identified. Conditions may be grouped.

B.2.2.1.3 Heat Input Range

For procedures intended to overcome the effect of heat removal by the flowing contents by using a sufficiently high heat input level (see 3.1.17) (heat input control procedures), the required heat input range should be specified. For procedures intended to overcome the effect of heat removal by the flowing contents by using the temper bead deposition sequence (temper bead procedures), the required heat input range for each layer should be specified. The heat input should be determined based on the equations in 5.3.2.6.

B.2.2.1.4 Weld Deposition Sequence

For procedures intended to overcome the effect of heat removal by the flowing contents by using the temper bead deposition sequence (temper bead procedures), the required weld deposition sequence should be specified. The weld deposition sequence should include tolerances for bead spacing to assure proper tempering of the previous passes.

B.2.3 Essential Variables

B.2.3.1 Changes Requiring Requalification

An in-service procedure should be requalified and established as a new procedure when any of the essential variables described in Table B.1 are changed. The procedure should be revised to show changes other than those listed in Table B.1, but requalification is not required. Essential variables applicable to procedure qualification are included in Table B.2 and compared against those required for welder qualification.

[22] CEIIW = %C + %Mn/6 + (%Cu + %Ni)/15 + (%Cr + %Mo + %V)/5.

Table B.1—Essential Variables for Qualification of Welding Procedure Specifications in Accordance with this Annex

Welding Variable Subsection[a]	Change Requiring Requalification
B.2.3.1.1 Materials	a) For in-service fillet welds, SMYS is not an essential variable.
	b) For in-service welds other than fillet welds, the strength of the completed weld should meet or exceed the specified minimum strength of the pipe and fitting material.
	c) An increase in the carbon equivalent above that of the material used for procedure qualification constitutes an essential variable, except as provided below. A procedure may be used for higher carbon equivalent materials than the material used for procedure qualification provided that the thermal conditions are less severe than the procedure qualification conditions and there is no increase in the risk of hydrogen cracking results.
B.2.3.1.2 Pipeline Operating Conditions	For in-service welds, an increase in the severity of the pipeline operating conditions (in terms of weld cooling rates) above the group qualified constitutes an essential variable.
B.2.3.1.3 Wall Thickness	a) For in-service welds other than weld deposition repairs, wall thickness is not an essential variable. However, wall thickness of the materials being welded should be considered when considering the thermal severity of the pipeline operating conditions.
	b) For weld deposition repairs, the qualified welding procedure should not be used on a remaining pipe wall thickness less than what was used during qualification.
B.2.3.1.4 Weld Deposition Sequence	a) A change from a deposition sequence that relies on tempering to some other deposition sequence constitutes an essential variable.
	b) For a deposition sequence that relies on tempering, a change in the bead spacing beyond the limits in the welding procedure specification constitutes an essential variable.
B.2.3.1.5 Welding Process	A change from the welding process, method of application, or combination thereof used to produce the welding procedure qualification test weld.
B.2.3.1.6 Joint Design	A major change in joint design, such as a change from a longitudinal groove seam weld to a branch groove weld. A branch groove weld qualifies for all fillet welds.
B.2.3.1.7 Filler Metal	A change of filler metal(s) listed in one filler metal group to another filler metal group listed in Table 2. The compatibility of the base material and the filler metal should be considered from the standpoint of mechanical properties and hydrogen cracking susceptibility.
B.2.3.1.8 Shielding Gas	a) A change in shielding gas classification in accordance with AWS A5.32.
	b) An increase or decrease in the range of flow rates for the shielding gas greater than 20 % of the nominal flow rate used during qualification testing.
B.2.3.1.9 Electrical Characteristics	A change from direct current (DC) electrode positive to DC electrode negative, or vice versa, or a change in current from DC to alternating current (AC), or vice versa.
B.2.3.1.10 Weld Heat Input	A change in the specified heat input range. The specified heat input range should be based upon consideration of the demonstrated heat input range used in testing and the heat input range that is likely to avoid both cracking and burn-through.
B.2.3.1.11 Time Between Passes	An increase in the maximum time between completion of the root bead and the start of the second bead constitutes an essential variable. An increase in the maximum time between completion of the first layer and the start of the second layer for a temper bead sequence constitutes an essential variable.
B.2.3.1.12 Direction of Welding	A change in the direction of welding from vertical down to vertical up, or vice versa.
B.2.3.1.13 Preheat Temperature	A decrease in the specified minimum applied preheat temperature used during production of the welding procedure qualification test weld. Preheat may be eliminated or reduced if thermal modeling shows that the change in preheat does not result in a faster weld cooling rate than was experienced during qualification testing. [b, c]

Table B.1—Essential Variables for Qualification of Welding Procedure Specifications in Accordance with this Annex (continued)

Welding Variable Subsection[a]	Change Requiring Requalification
B.2.3.1.14 Interpass Temperature	A decrease in the specified interpass temperature range. The interpass temperature may be decreased without retesting provided that the thermal conditions are less severe than the procedure qualification conditions and there is no increase in the risk of hydrogen cracking results. [b, c]
B.2.3.1.15 Postweld Heat Treatment	The addition of PWHT or a change from the ranges or values specified in the procedure each constitutes an essential variable. [d]
B.2.3.1.16 Postweld Heat Maintenance to Promote Hydrogen Diffusion	A reduction in the specified time or temperature range used during qualification of the procedure. The time or temperature may be decreased provided that the thermal conditions are less severe than the procedure qualification conditions and there is no increase in the risk of hydrogen cracking results.

[a] The subsection numbers in this column are provided for referencing purposes.

[b] Thermal analysis models, as referenced in B.1, are one way of determining how changes in welding procedure parameters can affect the risk of hydrogen cracking or burn-through.

[c] Increasing the preheat or the interpass temperature may increase susceptibility to burn-through in thin wall base metals.

[d] PWHT of in-service pipelines poses a safety hazard and is not recommended.

Table B.2—Essential Variables Applicable to Procedure and Welder Qualification

Variable	In-service Procedure	In-service Fillet Welder [a]	In-service Complete Penetration Branch Welder [a]	In-service Weld Deposition Repair Welder	Longitudinal Seam Welder [b]	In-service Repair Procedure	In-service Repair Welder
Welding Process	B.2.3.1.5	B.3.1	B.3.1	B.3.1	B.3.1	B.7.1.2.3	B.7.2.4
Filler Metal Strength for Pressure Containment Welds	[c]					[c]	
Carbon Equivalent	B.2.3.1.1					B.2.3.1.1	
Weld Cooling Rate	B.2.3.1.2	B.3.2	B.3.2	B.3.2	B.3.2	B.2.3.1.2	
Joint Design	B.2.3.1.6	B.3.1	B.3.1	B.3.1	B.3.1		
Repair Type						B.7.1.2.1	B.7.2.4
Remaining Wall Thickness at Base of Repair Groove							B.7.2.4
Thickness, if Remaining Thickness is Less Than 0.250 in. (6.4 mm) and Thickness is Less Than Tested	[d]					[d]	

Table B.2—Essential Variables Applicable to Procedure and Welder Qualification (continued)

Variable	In-service Procedure	In-service Fillet Welder [a]	In-service Complete Penetration Branch Welder [a]	In-service Weld Deposition Repair Welder	Longitudinal Seam Welder [b]	In-service Repair Procedure	In-service Repair Welder
Diameter		B.3.1	B.3.1				B.7.2.4
Thickness	B.2.3.1.3.(b)	B.3.1	B.3.1	B.3.1	B.3.1		B.7.2.4
Branch Diameter		B.3.1	B.3.1				B.7.2.4
Branch Thickness		B.3.1	B.3.1				B.7.2.4
Electrical Characteristics (polarity)	B2.3.1.9					B.2.3.1.9	
Heat Input	B.2.3.1.10	B.3.2	B.3.2	B.3.2	B.3.2	B.2.3.1.10	[e]
Position of Branch		B.3.1	B.3.1				B.7.2.4
Position of Groove				B.3.1	B.3.1		B.7.2.4
Position of Fillet		B.3.1	B.3.1				B.7.2.4
Direction of Welding	B.2.3.1.12	B.3.1	B.3.1	B.3.1	B.3.1	B.2.3.1.12	B.7.2.4
Weld Deposition Sequence	B.2.3.1.4	B.3.2	B.3.2	B.3.2	B.3.2	B.2.3.1.4	B.3.2
Filler Metal Group	B.2.3.1.7	B.3.1	B.3.1	B.3.1	B.3.1	B.2.3.1.7	B.7.2.4
Shielding Gas Type	B.2.3.1.8	B.2.3.1.8	B.2.3.1.8	B.2.3.1.8	B.2.3.1.8	B.2.3.1.8	
Shielding Gas Flow Rate	B.2.3.1.8					B.2.3.1.8	
Preheat Temperature	B.2.3.1.13					B.2.3.13	
Interpass Temperature	B.2.3.1.14					B.2.3.1.14	
Postweld Heat Maintenance	B.2.3.1.16					B.2.3.1.16	

[a] Section 6.1 provides additional allowances for in-service fillet and branch groove qualified welders for production welding applications.

[b] Annex B requirements are applicable to welds that fuse into the wall of an in-service pipeline or piping system.

[c] Filler metal strength is not an essential variable; however, for in-service welds other than fillet welds, such as branch groove welds, longitudinal seam welds of full-encirclement fittings, and weld deposition repairs, the strength of the completed weld should meet or exceed the specified minimum strength of the pipe and fitting material.

[d] When the remaining wall thickness is less than 0.250 in. (6.4 mm) the susceptibility burn-through from excessive heat input or other conditions that lead to high internal surface temperatures should be evaluated.

[e] Users are cautioned that deviating from tested heat inputs by significant amounts during production welding can contribute to increases susceptibility to cracking or burn-through in some cases.

B.2.4 Welding of Test Joints

B.2.4.1 General

Pipeline operating conditions that affect the ability of the flowing contents to remove heat from the pipe wall should be simulated while test joints are being made.

NOTE Filling the test section with water and allowing water to flow through the test section while the test joint is being made has been shown to produce thermal conditions equivalent to or more severe than typical in-service welding applications (see Figure B.2). Procedures qualified under these conditions are therefore suitable for any typical in-service application. Other media (e.g., motor oil) may be used to simulate less severe thermal conditions.

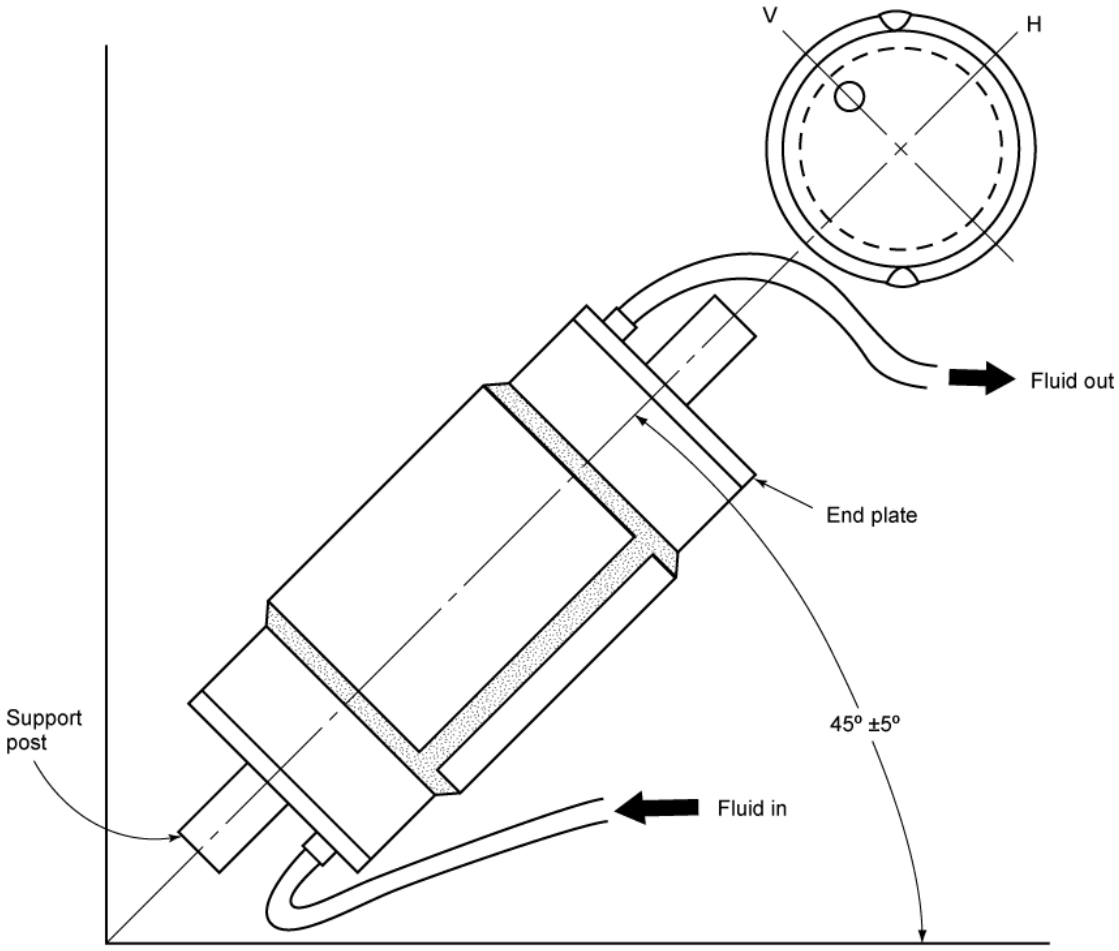


Figure B.2—An Example of Procedure and Welder Qualification Test Assembly

B.2.4.2 Branch and Fillet Welds

The requirements in 5.7 for branch groove welds and fillet welds should be applied to in-service welding.

B.2.4.3 Weld Deposition Repairs

Weld deposition repairs should be deposited on a section of pipe containing simulated wall loss. The area of simulated wall loss should be of sufficient size to remove all the required test specimens and may consist of a single larger area or multiple smaller areas (see B.2.5.1).

NOTE Other specimen layouts may be used at the discretion of the company.

The remaining wall thickness of the simulated wall loss should be no greater than the minimum value specified in the welding procedure specification. Weld deposition repairs should be deposited in such a way that the original wall thickness is completely restored.

B.2.5 Testing of Welded Joints

B.2.5.1 Preparation

The test specimens should be cut from the joint at the locations shown in Figure B.3 or Figure B.4, and the minimum number of specimens and the tests to which they are to be subjected are shown in Table B.3. The test specimens should not be cut, machined, or destructively tested less than 24 hours after welding.

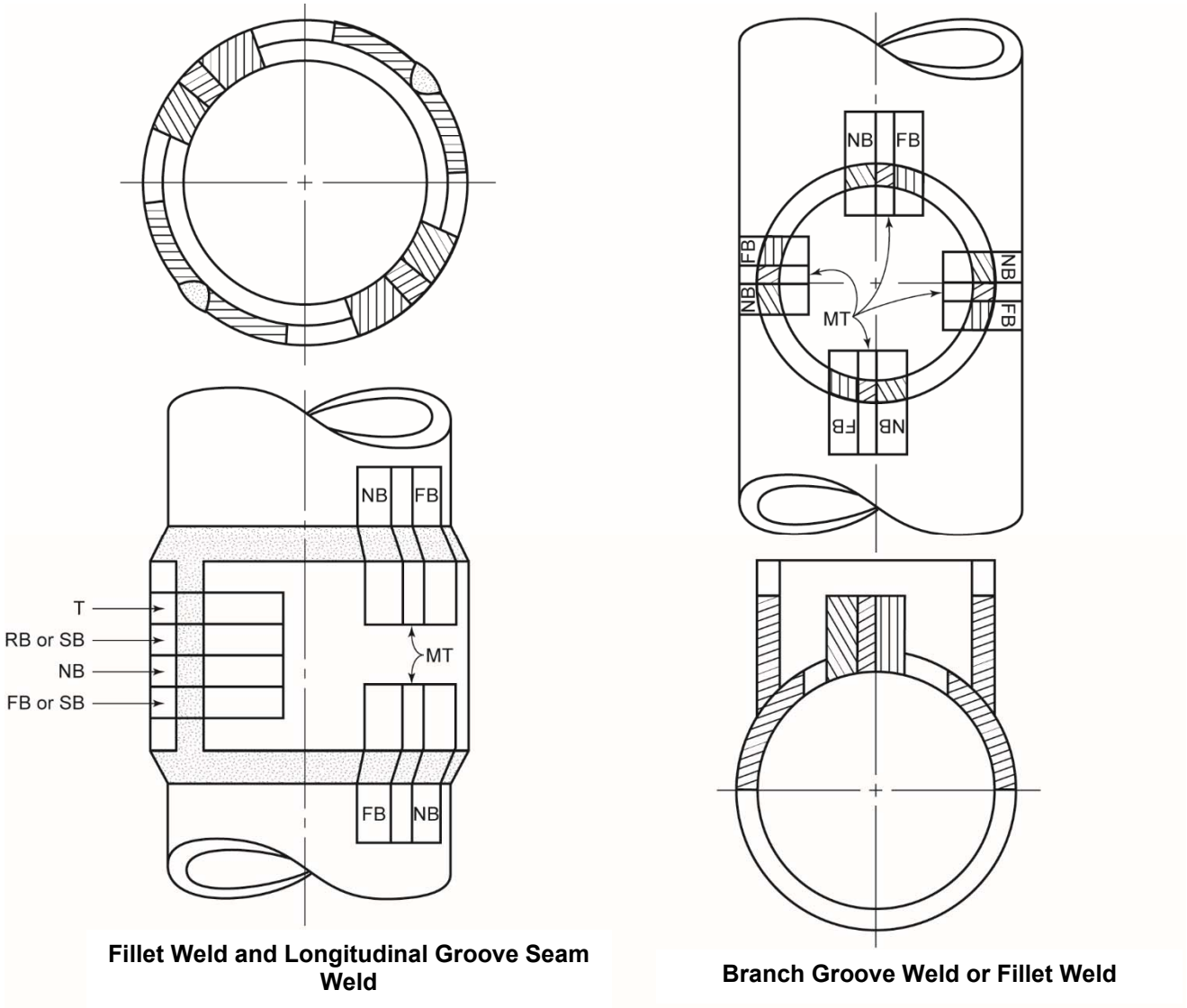
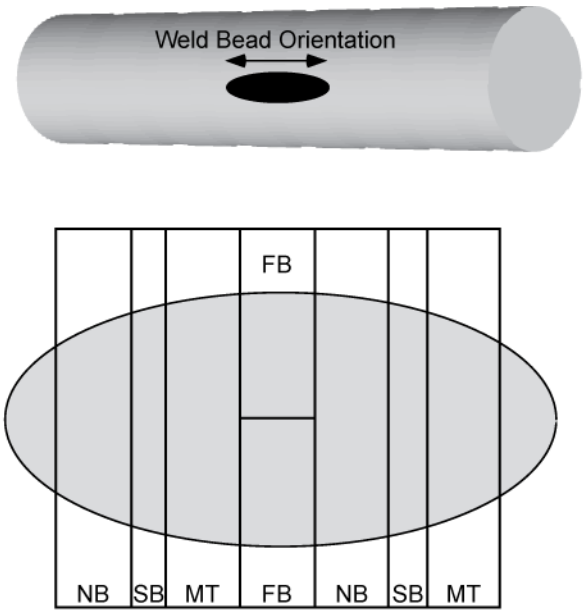
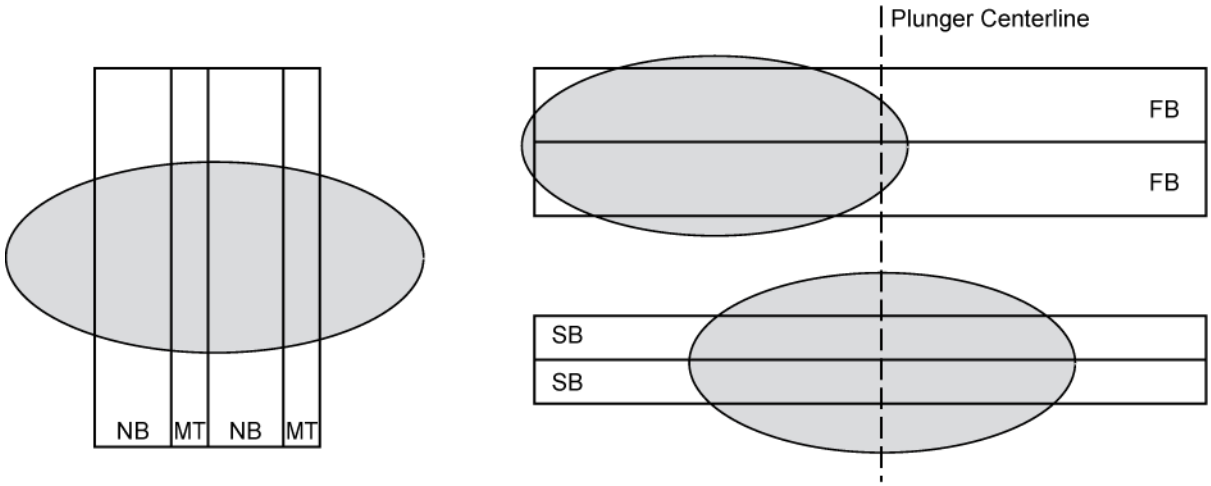


Figure B.3—Suggested Location of Test Specimens

Option 1:



Option 2:



NOTE 1 NB = nick-break; SB = side bend; MT = macro test; FB = face bend.

NOTE 2 The area of simulated wall loss should be of sufficient size to remove all the required test specimens and may consist of a single larger area (Option 1) or multiple smaller areas (Option 2).

Figure B.4—Suggested Location of Test Specimens for Weld Deposition Repair

Table B.3—Type and Number of Specimens—In-service Welding Procedure Qualification Test

Wall Thickness	Weld Type	Number of Specimens [a]						
		Tensile	Nick Break	Root Bend	Face Bend	Side Bend	Macro Test	Total
≤ 0.500 in. (12.7 mm)	Longitudinal groove seam	2	2	2	2			8
	Fillet		4 [b]		4		4	12
	Branch groove		4 [b]		4		4	12
	WDR [c]		2		4		2 [d]	8
> 0.500 in. (12.7 mm)	Longitudinal groove seam	2	2			4		8
	Fillet		4 [b]		4		4	12
	Branch groove		4 [b]		4		4	12
	WDR [c]		2		2	2	2 [d]	8

[a] For pipe or branch OD less than or equal to 4.500 in. (114.3 mm), two welds may be required.
[b] At the company's option, the remaining portion of these specimens may be prepared for and submitted to the face bend test (see B.2.5.5) after they are submitted to the nick break test.
[c] Weld deposition repairs.
[d] At the company's option, the remaining portion of these specimens may be prepared for and submitted to the face bend or side bend test (see B.2.5.5 or 5.6.5) after they are submitted to the macro test.

B.2.5.2 Longitudinal Groove Seam Welds

The longitudinal groove seam welds of full encirclement sleeves should be tested in accordance with 5.6. The backing material, if used, should be removed and the specimens may be flattened at room temperature before testing.

B.2.5.3 Branch Groove Welds, Fillet Welds, and Weld Deposition Repairs

Branch groove welds and fillet welds should be tested in accordance with 5.8, B.2.5.4, and B.2.5.5. Weld deposition repairs should be tested in accordance with 5.3.2, B.2.5.4, and B.2.5.5. When side bend tests are required, the side bend test should be performed in accordance with 5.6.5.

B.2.5.4 Macrosection Tests—Branch Groove Welds, Fillet Welds, and Weld Deposition Repairs

B.2.5.4.1 Preparation

The macrosection test specimens (see Figure B.5) should be at least $^1/_2$ in. (13 mm) wide. Specimens that are cut using a thermal process (plasma or oxygen) should be cut oversized and machined by a nonthermal process to remove at least $^1/_4$ in. (6 mm) from the side(s) that will be prepared. For each macrosection test specimen, at least one face should be ground to at least a 600-grit finish and etched with a suitable etchant, such as Nital, ammonium persulfate, or dilute hydrochloric acid, to give a clear definition of the weld structure.

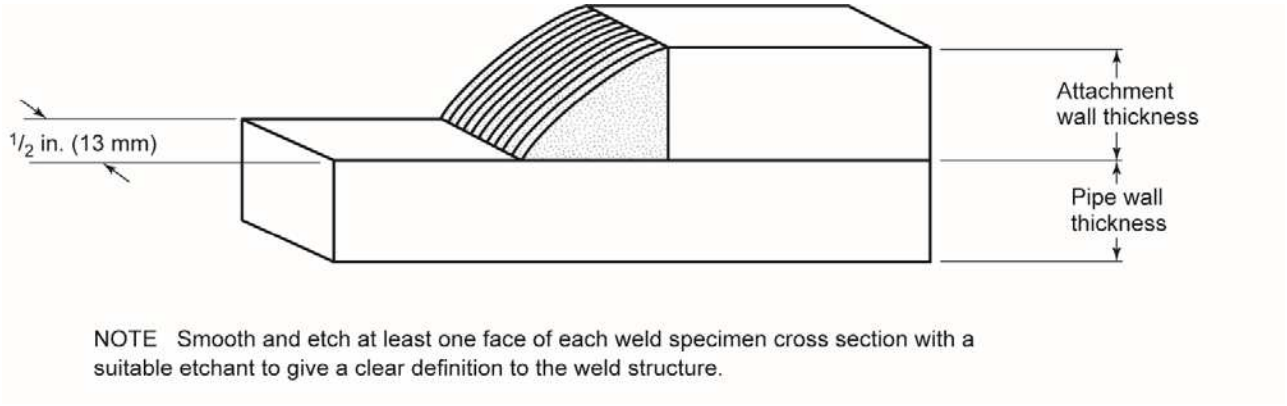


Figure B.5—Example Macro Test Specimen—In-service Fillet Welds

B.2.5.4.2 Visual Examination

The cross-section of the weld should be visually examined with lighting that will sufficiently reveal the details of the weld soundness. The use of optical devices or dye penetrants is not necessary.

B.2.5.4.3 Hardness Testing

Two of the four macro test specimens for branch groove and fillet welds and both macro test specimens for weld deposition repairs should be prepared for hardness testing in accordance with ASTM E384. A minimum of five indentations should be made using a Vickers indenter and a 10-kg load to determine the maximum hardness value in the coarse-grained HAZ at the weld toe of each specimen. A lower load may be used for the narrow heat-affected zones in some welds made by mechanized or automatic processes.

B.2.5.4.4 Requirements

A visual examination of the cross-section of the weld should show that it is completely fused at the root and free of cracks. For fillet welds, the leg lengths should be at least equal to the lengths specified in the welding procedure specification and should not deviate in concavity or convexity by more than $^1/_{16}$ in. (1.6 mm). The depth of the undercutting should not exceed $^1/_{32}$ in. (0.8 mm) or 12 $^1/_2$ % of the pipe wall thickness, whichever is smaller. The hardness for all welds onto in-service piping should not exceed the values shown in Table B.4[23] or alternate values specified by the company.

The effective thickness in Table B.4 should be calculated per Equation (B.1):

$$t_e = \frac{2t_s + t_a}{3} \tag{B.1}$$

where

t_e = effective thickness (in. or mm);

t_s = thickness of the pipe (in. or mm);

t_a = thickness of the appurtenance (in. or mm).

NOTE These values may not be applicable to microalloyed steel (with < 0.10% C) or to grades having an SMYS of 80 ksi or greater.

[23] Bruce, W. A., and Etheridge, B. C., “Further Development of Heat-Affected Zone Hardness Limits for In Service Welding", Proceedings of the 9th International Pipeline Conference, Paper No. IPC2012-90095, Calgary, Alberta, Canada, September 24-28, 2012.

Table B.4—Weld Maximum Hardness Values, Non-Sour Service, HV10 [a]

Effective Thickness, [b, c] in. (mm)	≤0.375 (9.5)		0.500 (12.7)		0.625 (15.9)		≥0.750 (19.1)	
CE IIW [c]	≤ 0.35	≥ 0.5	≤ 0.35	≥ 0.5	≤ 0.35	≥ 0.5	≤ 0.35	≥ 0.5
Low-hydrogen welding process (max 4 ml/100 gm weld metal)	375	425	358	408	342	392	325	375
Low-hydrogen welding process (max 8 ml/100 gm weld metal [d])	350	400	335	383	317	367	300	350
Any welding process	300	350	285	335	265	315	250	300

[a] Hardness values are the average of five measurements taken in the region of anticipated maximum hardness. For sour service, see applicable the governing standard or specification document.

[b] Effective thickness (t_e) is calculated per Equation (B.1).

[c] Linear interpolation for hardness values is permitted for intermediate thickness values and/or CE values. See example below.

[d] 8 ml/100 gm weld metal could apply to low hydrogen welding processes or filler metals that result in more than 4 ml/100 gm weld metal by virtue of filler metal specification or by use of low hydrogen electrodes that have been exposed to uncontrolled atmospheric conditions that promote moisture pickup.

EXAMPLE (Pipe wall thickness of 0.406 and CE of 0.4 for “any welding process”)

Interpolation for wall thickness

For CE = 0.35, HV10 = 300 - ((0.406-0.375) * (300-285) / (0.500-0.375)) = 296

For CE = 0.5, HV10 = 350 - ((0.406-0.375) * (350-335) / (0.500-0.375)) = 346

Final Interpolation for CE of 0.4

HV10 = 296 + (0.4-0.35) * (346-296) / (0.5-0.35) = 313

B.2.5.5 Face Bend Test—Branch Groove Welds, Fillet Welds, and Weld Deposition Repairs

B.2.5.5.1 Preparation

The face bend specimens (see Figure B.6) should be approximately 9 in. (230 mm) long and approximately 1 in. (25 mm) wide. Specimens that are cut using a thermal process (plasma or oxygen) should be cut oversized and machined by a nonthermal process, to remove at least $^1/_8$ in. (3 mm) from each side. The sides should be smooth and parallel, and the long edges should be rounded. The sleeve or branch and reinforcements should be removed flush with the surface but not below the surface of the test specimen. Any undercut should not be removed. Specimens should not be flattened prior to testing.

NOTE 1 The test specimens in Figure B.6 are shown in the axial direction; specimens in the other direction are curved.

NOTE 2 In lieu of taking separate specimens for the face bend test, the remaining portion of the nick break specimens may be used.

NOTE 3 Where wall thickness is greater than 0.500 in. (12.7 mm), it may be reduced to 0.500 in. (12.7 mm) by machining the inside surface.

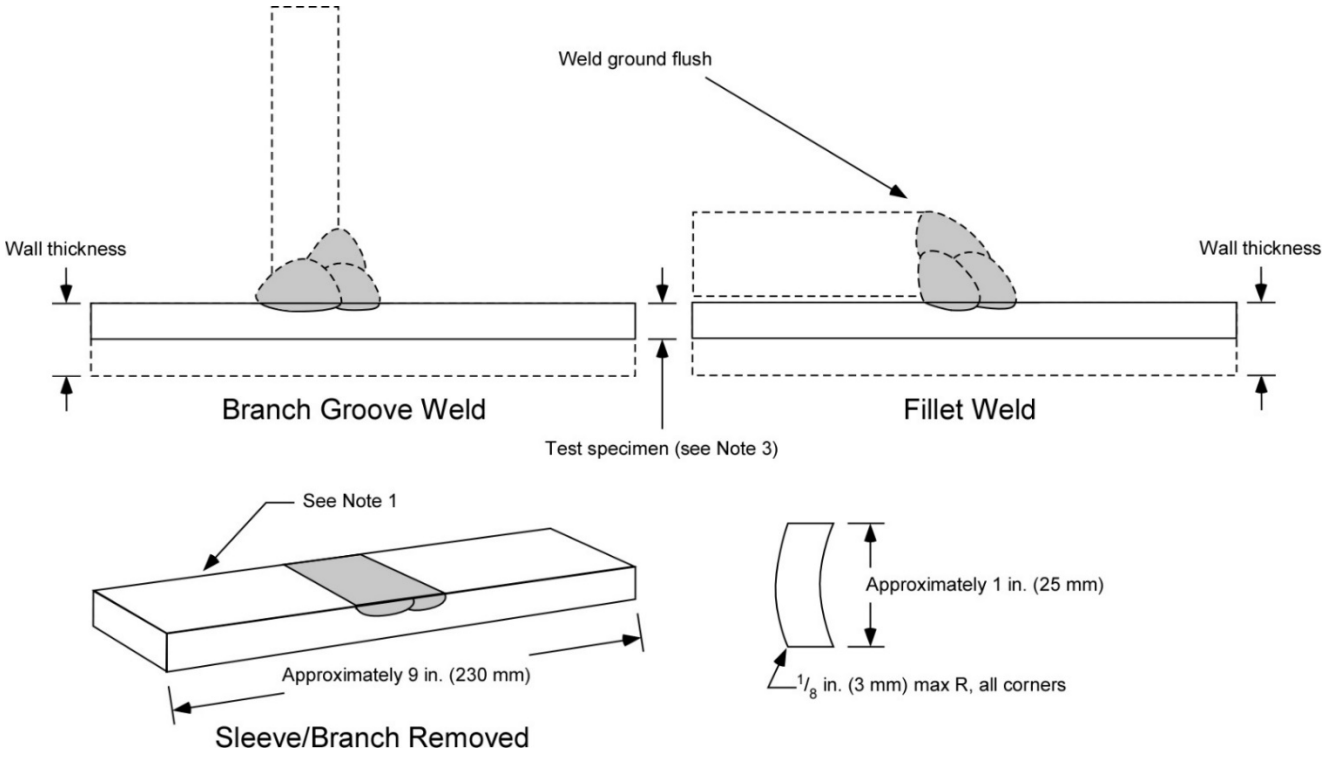


Figure B.6—Face Bend Test Specimen

B.2.5.5.2 Method

The face bend specimens should be bent in a guided-bend test jig similar to that shown in Figure 8. The bend radii may be equal to or smaller than the radii in Figure 8. Each specimen should be placed on the die with the cap pass weld toe area at midspan. The face of the weld should be placed toward the gap. The plunger should be forced into the gap until the curvature of the specimen is approximately U-shaped.

B.2.5.5.3 Requirement

The face bend test should be considered acceptable if, after bending, no crack or other imperfection exceeding $^1/_8$ in. (3 mm) or one-half the specified wall thickness, whichever is smaller, in any direction is present in the weld metal or HAZ. Cracks that originate on the outer radius of the bend along the edges of the specimen during testing and that are less than $^1/_4$ in. (6 mm), measured in any direction, should not be considered unless obvious imperfections are observed.

B.3 In-service Welder Qualification

B.3.1 General

A welder should make a test weld using a qualified in-service welding procedure in accordance with requirements in B.3.2. A welder depositing a weld deposition repair should deposit a test weld using a qualified in-service welding procedure in accordance with B.3.2 and B.2.4.3. The test welds should be tested in accordance with B.3.3. A welder who successfully completes the test weld should be qualified within the limits of the essential variables described below.

a) A change from one welding process to another welding process or combination of processes, as follows.

   1) A change from one welding process to a different welding process; or

2) A change in the combination of welding processes, unless the welder has qualified on separate qualification tests, using each of the welding processes that are to be used for the combination of welding processes.

b) A change in the direction of welding from vertical up to vertical down or vice versa.

c) A change of filler metal classification from Group 1 or 2 to any other group or from Group 3 through 8 to Group 1 or 2 (see Table 2). A change of filler metal classification not listed in Table 2 to any other filler metal classification or vice versa.

d) A major change in joint design. A minor change in joint design (e.g., angle of bevel) is not a change in the essential variable:

1) An in-service welder who qualifies depositing a fillet weld is qualified to deposit a fillet weld between a pipe and a sleeve or a pipe and a branch. Section 6.1 provides additional allowances for in-service fillet and branch groove qualified welders for production welding applications.

2) An in-service welder who qualifies depositing a branch groove weld joint that includes a groove and fillet weld is qualified for all branch welds and all fillet welds. Section 6.1 provides additional allowances for in-service fillet and branch groove qualified welders for production welding applications.

3) An in-service welder who qualifies by depositing an in-service longitudinal groove seam weld is qualified to deposit longitudinal groove seam welds that fuse to the carrier pipe and longitudinal groove seam welds with a backing strip. A welder who qualifies by depositing a longitudinal groove seam weld with a backing strip is only qualified to deposit longitudinal groove seam welds with a backing strip.

NOTE A longitudinal groove seam welder who qualifies with an open root is qualified to deposit non-in-service longitudinal groove seam welds within the limits of 6.2.

4) The joint design is not an essential variable for weld deposition welders.

e) An increase in the specified OD of the pipe and branch or sleeve.

1) An in-service welder who qualifies depositing a fillet weld on a nominal pipe and sleeve or branch diameter of 12.75 in. (323.9 mm) or greater is qualified for all pipe, sleeve, and branch diameters.

2) An in-service welder who qualifies depositing a branch groove weld, a joint that includes a groove and fillet weld, on a nominal pipe and branch diameter of 12.75 in. (323.9 mm) or greater is qualified for all pipe, sleeve, and branch diameters.

3) The pipe or sleeve diameters are not essential variables for weld deposition and longitudinal groove seam welders.

f) An increase in the specified thickness of the pipe and branch or sleeve. When welding on pipe wall thickness values less than 0.25 in. (6.4 mm), the welder should show to the satisfaction of the company the ability to prevent burn-through.

1) An in-service welder who qualifies depositing a fillet weld on a nominal pipe and sleeve or branch wall thickness of 0.250 in. (6.4 mm) or greater is qualified for all pipe, sleeve, and branch wall thicknesses.

2) An in-service welder who qualifies depositing a branch groove weld, a joint that includes a groove and fillet weld, on a nominal pipe and branch wall thickness of 0.250 in. (6.4 mm) or greater is qualified for all pipe, sleeve, and branch wall thicknesses.

3) A longitudinal groove seam welder who qualifies on a sleeve wall thickness of 0.375 in. (9.5 mm) or greater is qualified to deposit longitudinal groove seam welds on all sleeve wall thicknesses.

4) For weld deposition welders, the pipe wall is not an essential variable; however, the welder is only qualified to weld a remaining wall thickness no less than the remaining wall thickness used during the qualification.

g) A change in welding position.

1) An in-service welder who qualifies depositing a fillet weld on a pipe and sleeve in the horizontal or inclined 45° from the horizontal position, or a pipe in the horizontal or inclined 45° from the horizontal position with the branch positioned on the side of the pipe, the bottom of the pipe, or any location between the side and bottom of the pipe, is qualified for all positions.

2) An in-service welder who qualifies depositing a branch groove weld, a joint that includes a groove and fillet weld, on a pipe in the horizontal or inclined 45° from the horizontal position with the branch positioned on the side of the pipe, the bottom of the pipe, or any location between the side and bottom of the pipe is qualified for all positions.

3) A longitudinal groove seam welder who qualifies on a sleeve in the horizontal or inclined 45° from the horizontal position is qualified for all positions.

4) For weld deposition repair welders, a pipe in the horizontal or inclined 45° from the horizontal position with the weld deposition repair deposited on the bottom of the pipe qualifies the weld deposition repair welder for all positions; repairs deposited on the side of the pipe qualify the weld deposition repair welder for the side and top of the pipe; and repairs deposited on the top of the pipe qualify the weld deposition repair welder for only the top of the pipe.

B.3.2 Welding of Test Joint

For in-service welding, pipeline operating conditions that affect the ability of the flowing contents to remove heat from the pipe wall should be simulated while test joints are being made.

NOTE Filling the test section with water and allowing water to flow through the test section while the test joint is being made has been shown to produce thermal conditions equivalent to or more severe than typical in-service welding applications (see Figure B.2). Welders qualified under these conditions are therefore qualified for any typical in-service application. Other media (e.g., motor oil) may be used to simulate less-severe thermal conditions.

In addition to making the test joint used for the destructive testing described in B.3.3, the welder should demonstrate to the satisfaction of the company the ability to comply with aspects of the welding procedure specification that are intended to avoid the development of crack-susceptible microstructures and/or prevent burn-through. For example, for heat input control procedures, the company may choose to require the welder to demonstrate the ability to maintain a heat input level within the range specified in the welding procedure specification. For temper bead and weld deposition repair procedures, the company may choose to require the welder to demonstrate bead placement within the dimensional tolerances specified in the welding procedure specification and the ability to maintain a heat input level within the range specified in the welding procedure specification.

B.3.3 Testing of Welded Joints

The weld should be tested and considered to be acceptable if it meets the requirements of 6.4 and 6.5. For longitudinal groove seam welds that are prevented from fusing directly into the wall of the simulated in-service pipeline or piping system because of the welding process, welding technique, joint geometry, physical barrier, or a combination of these attributes, the minimum number of specimens and the tests to which they should be subjected is shown in Table B.5. For longitudinal fillet welds, test four nick-break specimens equally spaced along the fillet weld. For weld deposition repair welders, the minimum number of specimens and tests to which they should be subjected is shown in Table B.3. However, for the purpose of welder qualification under B.3, it is not necessary to calculate the tensile strength of the coupons. If

calculating the tensile strength of the coupon is not performed, the specimen designated for the tensile test should be subjected to the nick-break test.

Table B.5—Type and Number of Test Specimens for Longitudinal Groove Seam—Welder Qualification

Sleeve Wall Thickness	Tensile	Number of Specimens				
		Nick Break	Root Bend	Face Bend	Side Bend	Total
≤ 0.500 in. (12.7 mm)	1	1	1	1		4
> 0.500 in. (12.7 mm)	1	1			2	4

B.3.4 Records

The pipeline operating conditions (pipe contents, flow rate, etc.) for which the welder is qualified should be identified. Conditions may be grouped.

B.4 Suggested In-service Welding Practices

B.4.1 General

The requirements for production welding in Section 7 should be applied to in-service welds, except for the alternative/additional requirements specified in this annex.

Before welding onto an in-service pipeline or piping system, welders should consider aspects that affect safety, such as operating pressure, flow conditions, and wall thickness at the location of the welding. The areas to be welded should be inspected to ensure that imperfections are not present and that the wall thickness is adequate. All welders performing repair work should be familiar with the safety precautions associated with cutting and welding on piping that contains or has contained crude petroleum, petroleum products, or fuel gases. Additional guidance can be found in API 2201.

B.4.2 Alignment

B.4.2.1 Fit-up

For sleeves or saddles, the gap between the sleeve or saddle and the carrier pipe should be within the dimensional tolerances specified by the company. Clamping devices should be used to obtain proper fit-up. When necessary, weld metal buildup on the carrier pipe can be used to minimize the gap.

B.4.2.2 Root Opening—Longitudinal Groove Seam Welds

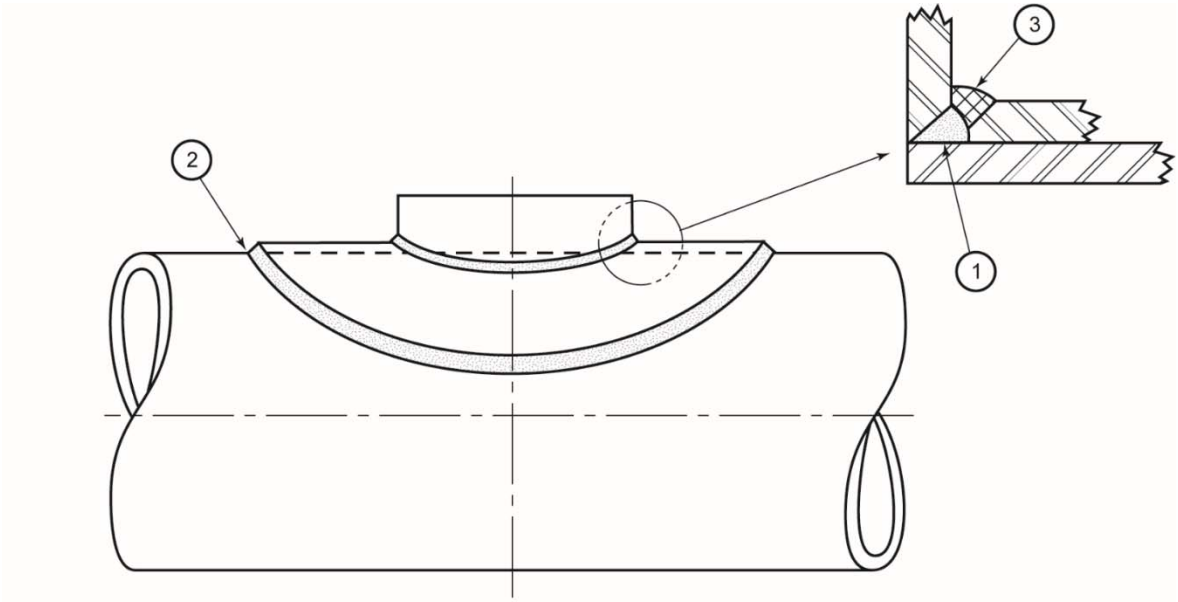
For longitudinal groove seam welds, when 100 % penetration is required, the root opening (the space between abutting edges) should be sufficient to enable full penetration of the root bead. These joints should be fitted with a mild steel backup strip or suitable tape to prevent penetration of the weld into the carrier pipe.

NOTE Penetration of the longitudinal groove seam weld into the carrier pipe is undesirable since any crack that might develop is exposed to the hoop stress in the carrier pipe. When weld metal does not penetrate into the carrier pipe, the longitudinal groove seam weld is not an in-service weld.

B.4.3 Welding Sequence

Suggested sleeve and branch welding sequences are shown in Figure B.7 through Figure B.12. For full-encirclement fittings requiring circumferential fillet welds, the longitudinal seams should be completed before beginning the circumferential welds. The circumferential weld at one end of the fitting should be completed before beginning the circumferential weld at the other end. For other types of fittings, a welding sequence that minimizes residual stress should be used.

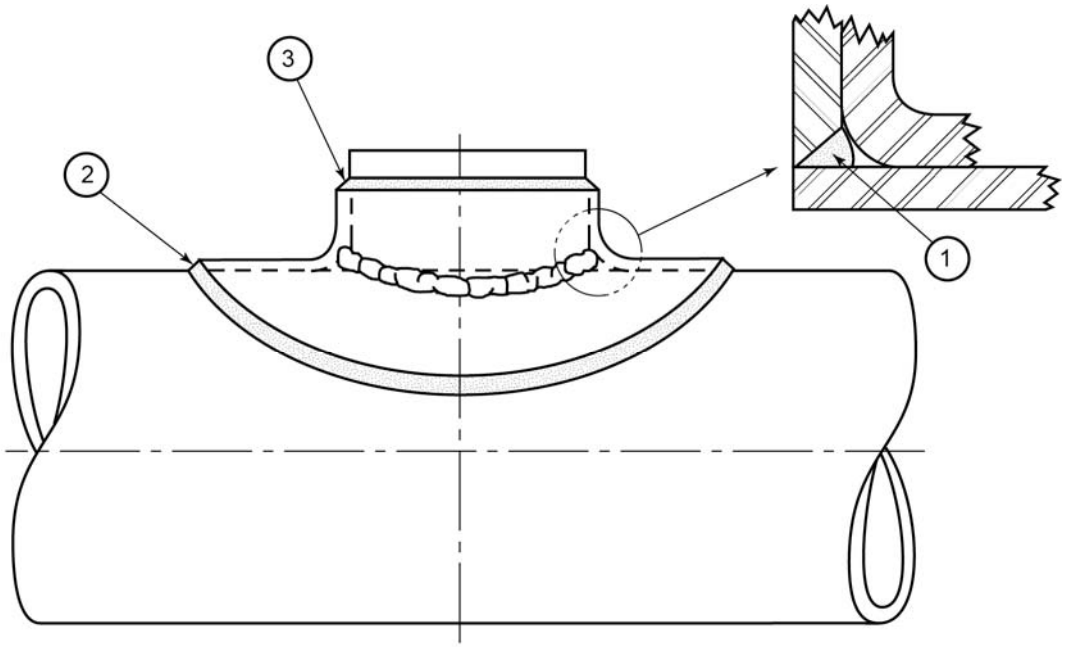
Guidelines for weld deposition repair have been developed that include preparation prior to welding and weld deposition sequence. [24] For example, a perimeter pass should be used to establish a boundary beyond which no subsequent welding is allowed. The first layer of fill passes should be deposited using established heat input limits to minimize the risk of burn-through. A second perimeter pass should be used to temper the HAZ at the toe of the first perimeter pass. Higher heat input fill passes should be used for subsequent layers to further temper the initial passes, again observing established heat input limits if necessary. Additional layers should be deposited, as necessary, for proper filling.



NOTE This is the suggested welding sequence; others may be followed at the discretion of the company.

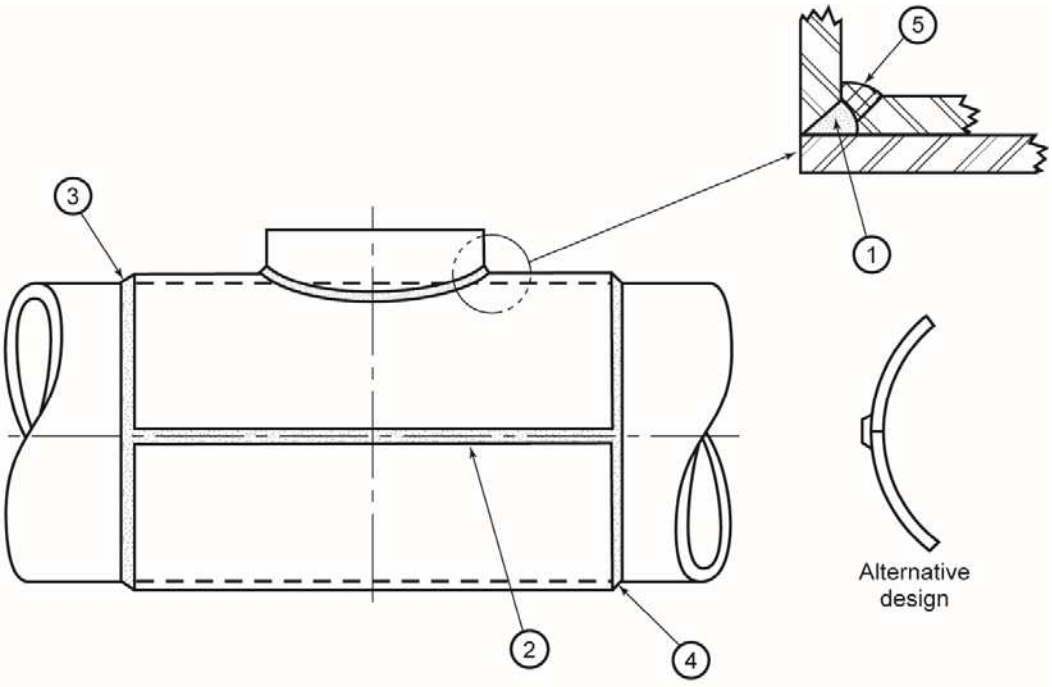
Figure B.7—Reinforcing Pad

[24] W. A. Bruce and W. E. Amend, “Guidelines for Pipeline Repair by Direct Deposition of Weld Metal,” WTIA/APIA Welded Pipeline Symposium, Welding Technology Institute of Australia, Sydney, Australia, April 3, 2009.



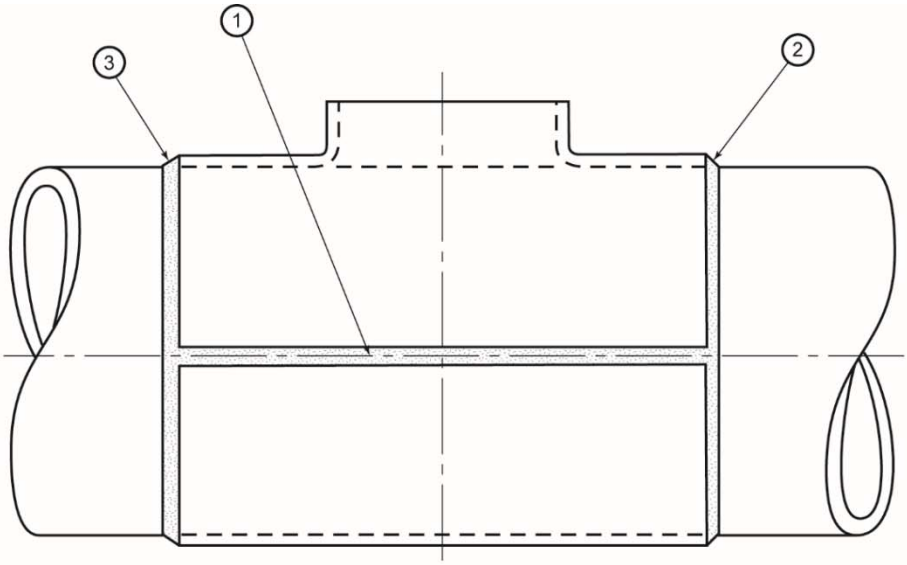
NOTE This is the suggested welding sequence; others may be followed at the discretion of the company.

Figure B.8—Reinforcing Saddle



NOTE This is the suggested welding sequence; at the discretion of the company, others may be followed and circumferential welds, numbers 3 and 4, need not be made.

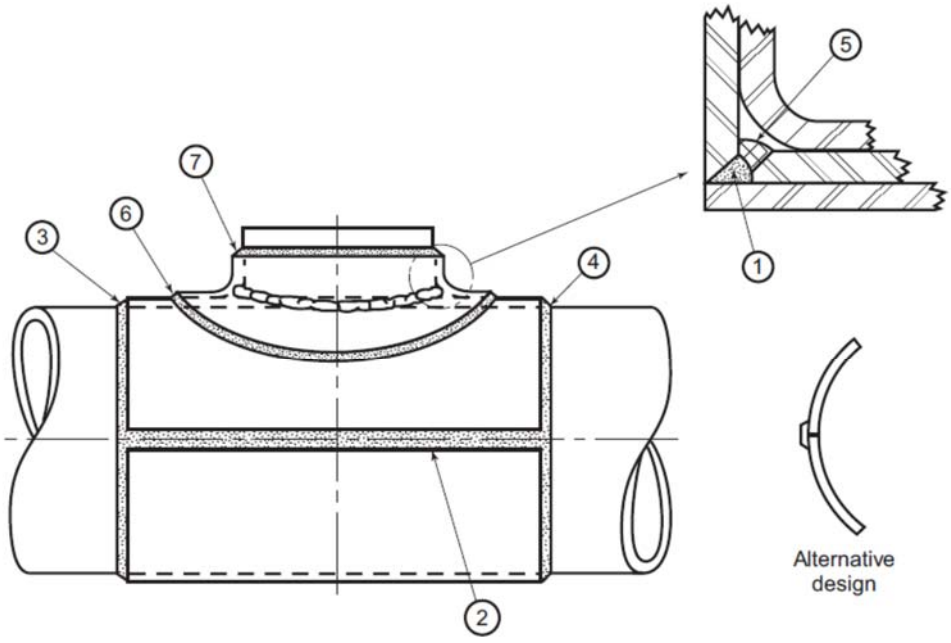
Figure B.9—Encirclement Sleeve



NOTE 1 This is the suggested welding sequence; others may be followed at the discretion of the company.

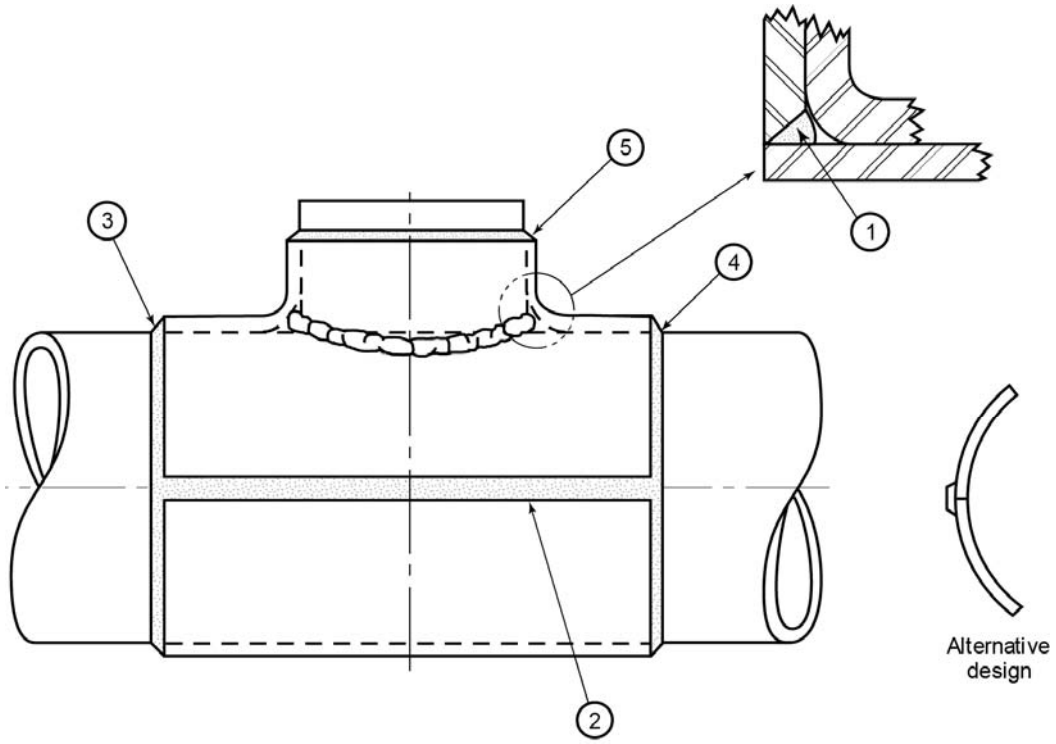
NOTE 2 When in operation, the fitting is at pipeline pressure.

Figure B.10—Encirclement Tee

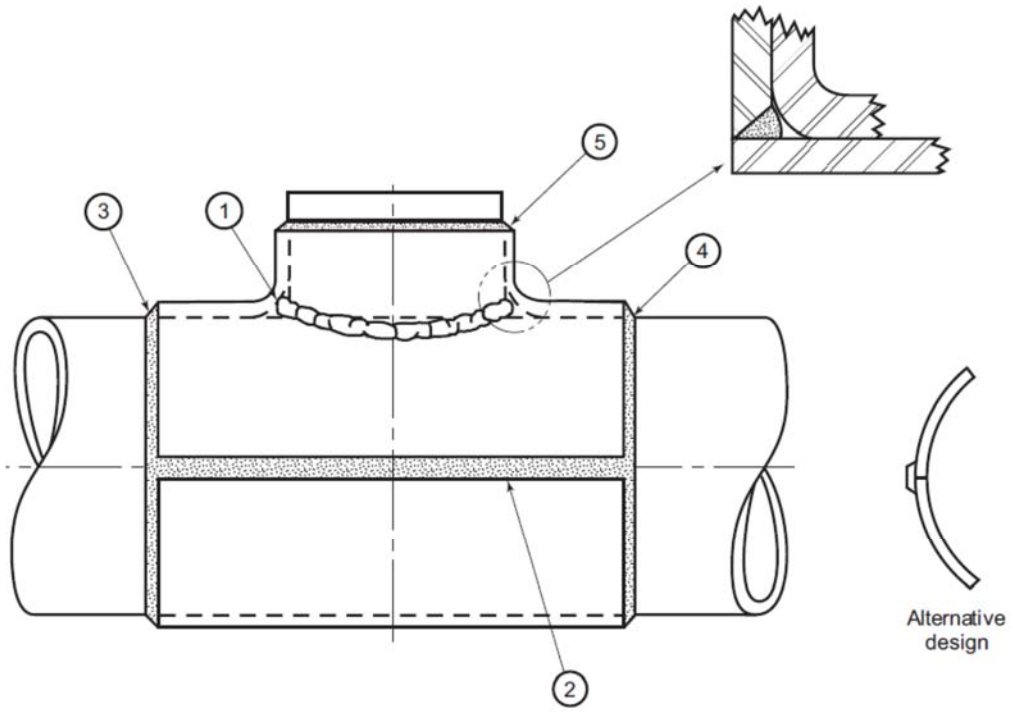


NOTE This is the suggested welding sequence; at the discretion of the company, others may be followed and circumferential welds, numbers 3 and 4, need not be made.

Figure B.11—Encirclement Sleeve and Saddle



NOTE This is the suggested welding sequence; at the discretion of the company, others may be followed and circumferential welds, numbers 3 and 4, need not be made.



NOTE This is the suggested welding sequence; at the discretion of the company, others may be followed and circumferential welds, numbers 3 and 4, need not be made.

Figure B.12—Encirclement Saddle

B.4.4 Weld Direction

In-service welds should be deposited in the circumferential direction (parallel to the hoop stress direction) whenever possible.

B.5 Inspection and Testing of In-service Welds

The requirements for inspection and testing in Section 8 should be applied to in-service welds, except for the alternative/additional requirements specified in this annex.

Since in-service welds may be particularly susceptible to underbead or delayed hydrogen cracking, an inspection method that is capable of detecting these cracks, particularly at the carrier pipe weld toe, should be used.

NOTE Magnetic particle testing, ultrasonic testing, or a combination of both, using properly developed, qualified, and approved procedures, have been shown to be effective at detecting hydrogen cracks at the toe of sleeve-, saddle-, and branch-to-carrier pipe welds. Ultrasonic testing and radiographic testing, or a combination of both, are effective for volumetric inspection for weld deposition repairs.

When determining appropriate delay times prior to inspection for hydrogen cracking, the time-dependent nature of cracking should be considered, as well as the probability of the weld to cracking. Longer delay times decrease the chance that cracking can occur after inspection has been completed. The probability of cracking, and thus the importance of determining an appropriate delay time, can be minimized by using more conservative welding procedures.

B.6 Standards of Acceptability—NDT (Including Visual)

The standards of acceptability in Section 9 for imperfections located by NDT should be applied to in-service welds. For weld deposition repair, the weld length is defined as the maximum weld length in the direction in which the wall loss is oriented.

B.7 Repair of Welds while In-Service

This section pertains to weld repairs made to new welds made onto in-service piping and to the repair of weld flaws or in-service degradation of construction welds on piping that is in-service. When construction welds that are in-service are to be repaired, the welds should be volumetrically inspected to ensure that significant imperfections are not present below the surfaces that will be affected by grinding or welding. Grinding should not be performed on construction welds that are now in-service and cannot be volumetrically inspected.

The first attempt to repair a new in-service weld should be made by a qualified in-service welder using the original in-service welding procedure specification. If a second attempt is required, then an in-service repair welding procedure and in-service repair welder should be qualified in accordance with B.7.

Any repair to a construction weld should be performed following a repair in-service welding procedure and by an in-service repair welder qualified in accordance with B.7. A welder who has qualified under 10.4 and who has qualified according to B.3 should be qualified to perform in-service weld repairs to a construction weld.

B.7.1 In-service Repair Welding Procedure Qualification

B.7.1.1 General

An in-service repair procedure should be reestablished as a new repair procedure and should be requalified when any of the essential variables in B.2.3 or the following are changed.

NOTE Changes other than those given in B.2.3 or B.7.1.2 may be made without the need for requalification, provided the repair procedure is revised to show the changes.

B.7.1.2 Essential Variables

Essential variables applicable to in-service repair procedure qualification are included in Table B.6.

Table B.6—Essential Variables for Qualification of Repair Welding Procedure Specifications in Accordance with this Annex

Welding Variable Subsection[a]	Change Requiring Requalification
B.7.1.2.1 Location of Excavation [b]	a) A change from centerline to fusion line location for excavation of partial-thickness repairs. [c]
	b) A change from centerline to fusion line location for cover pass repairs. [c]
B.7.1.2.2 Type of Repair	Any change from a repair type listed below to another repair type, except when changing from a full-thickness repair to a partial-thickness repair. 1) full-thickness repair; 2) partial-thickness repair; 3) cover pass repair; 4) back weld repair.
B.7.1.2.3 Change in Welding Process	a) A change in the welding process or method of application used to produce the repair procedure qualification test weld.
	b) A change in the welding process used to deposit the original production weld being repaired.
	c) If the weld to be repaired was produced using the OFW or self-shielded flux-cored arc welding (FCAW-S) process, procedure qualification testing should be performed on a weld that was originally deposited using the same process.

[a] The subsection numbers in this column are provided for referencing purposes.

[b] Refer to illustrations in Figures 22 through 27 for definitions of excavation locations.

[c] Qualification of fusion line repairs qualifies for use on centerline repairs.

B.7.1.3 Testing of Repair

In-service repair procedures should be qualified by visual and destructive testing. NDT may be required at the direction of the company. For repair procedure qualification, sample preparation for destructive testing and nondestructive testing should not commence until the repair weld has been allowed to cool to ambient temperature.

The repair weld should be tested and considered to be acceptable if it meets the requirements of B.2.5. For repair welds, the minimum number of specimens and the tests to which they should be subjected is shown in Table B.7. At the discretion of the company, additional types and number of tests may be required. When the production in-service welding procedure was required to be qualified with Charpy impact testing to meet design requirements, Charpy impact testing should also be performed to qualify partial-thickness and full-thickness repair procedures. As noted in Table 3, when wall thickness is over 0.500 in. (12.7 mm), the side bend tests should be substituted for face bend or root bend tests. For the purpose of this section, preparation of the repair area that results in weld metal or base metal remaining at the base of the groove is considered to be a partial-thickness repair. Grinding that results in an open root (e.g., grinding through the root of a new branch connection that has not been tapped yet) is considered to be a full-thickness repair. Complete removal of a fillet weld that does not result in an open root is qualified as a partial-thickness repair (e.g., a sleeve fillet weld in which the weld metal is removed to the root is not an open root joint).

NOTE Dependent on pipe material or welding process, the company may require additional delay time prior to destructive and nondestructive testing.

Table B.7—Type and Number of Specimens—In-service Welding Repair Procedure Qualification Test

Repair Type	Tensile Strength	Face Bend	Macro/ Hardness [a]	Total (Minimum)	Charpy Impact
Branch full-thickness	0	1	1	2	0
Partial-thickness (groove welds) and WDR	1	1	1	3	[a]
Partial-thickness (includes branch and fillet welds)	0	1	1	2	0
Cover pass	0	1	1	2	0
Branch back weld	0	1	1	2	0

[a] Hardness and Charpy impact testing should be performed at locations in the weld as specified by the company. The number of test specimens and acceptance criteria should be specified by the company

B.7.2 In-service Repair Welder Qualification

B.7.2.1 General

When required by B.7, in-service repairs should be made by an in-service repair welder, following an in-service repair welding procedure specification or using the original in-service welding procedure specification. The in-service repair welder should be qualified by either of the following two ways:

a) depositing an in-service repair weld in accordance with B.7.2.2. The weld should be acceptable if it meets the requirements of B.7.2.3;

b) qualifying as a repair welder in accordance with 10.4 and having an in-service welder qualification in accordance with B.3.

B.7.2.2 Repair Welder Testing

Welders should be qualified using a completed weld to make an in-service repair weld following all the details of the qualified in-service repair welding procedure specification.

The in-service repair weld should be deposited in the fixed position on a full-circumference test weld and qualified in the location(s) specified by the company. The base metal grade is not an essential variable for in-service repair welding. The substrate weld is not an essential variable; however, if the repair is intended for use on either OFW weld metal deposits or self-shielded flux-cored arc welding (FCAW-S) weld metal deposits, the substrate weld metal should be representative of that weld process. The welder should prepare the repair groove for the repair test.

The piping should be subject to accelerated cooling during the repair welding

The in-service repair weld should be of sufficient length to extract all of the required destructive test specimens.

A single completed weld may be used to qualify more than one welder or repair location.

Details of the in-service repair welder qualification should be recorded and maintained with the complete results of the qualification test for each location of repair in accordance with 6.8.

B.7.2.3 Testing of Repair

For a repair welder qualification test weld, the repair weld shall meet the visual examination requirements of 6.4.

The destructive test samples should be removed from each individual repair area. For repairs to fillet welds or branch groove welds, two nick breaks should be removed and tested in accordance with 6.5 for each type of repair weld. For repairs to butt welds, the destructive test samples should be removed and tested in accordance with 10.4.2.

A welder who fails to pass the in-service repair welder qualification test(s) should be permitted to retest as described in 6.7.

B.7.2.4 Welder Qualification Limits

An in-service repair welder who has qualified in accordance with B.7.2.1.1 should be qualified within the limits of the essential variables described below and in B.3.4. If any of the following essential variables are changed, the in-service repair welder using an in-service repair procedure should be requalified:

a) a change from cover pass or back weld repair to partial-thickness or full-thickness repair type;

b) a change of the filler metal group (see Table 2);

c) a decrease in the remaining ligament thickness after preparing the repair groove to less than the remaining ligament used in the in-service repair welder qualification test;

d) a change in position from that for which the in-service repair welder has already qualified. Qualification testing on the bottom qualifies the welder for all positions. Qualification welding on the side qualifies for repairs on top and side only. Qualification welding on the top position qualifies for top only;

e) a change in the thickness group of the branch connections or, for girth weld repairs or WDR, a change in the thickness group for the pipe or fitting being repaired. These groups are defined in Table 5;

f) A change in the direction of travel from vertical up to vertical down or vice versa, or from horizontal to either vertical up or vertical down. Vertical welding qualifies the welder for horizontal progression welding.

g) An in-service repair welder who has qualified in accordance with B.7.2.1.2 should be qualified within the limits of the essential variables described in 10.4.3 and B.3.4.

Annex C
(normative)

Requests for Interpretation and Requests for Revision to the Document

C.1 Introduction

The API-AGA Joint Committee on Oil and Gas Pipeline Field Welding Practices will consider written requests for interpretations and revisions in a formal manner. The committee's activities in this regard are limited strictly to interpretations of this standard, or to the consideration of revisions to this standard on the basis of new data or technology. Such requests are handled as expeditiously as possible, but due to the complexity of the work and the procedures that shall be followed, some responses may require considerable time. As a matter of policy, API does not approve, certify, rate, or endorse any item, construction, proprietary device, or activity related to the use of this standard. Accordingly, any requests for interpretation requiring such consideration shall not be addressed. API does not act as a consultant on specific welding problems or on the general application or understanding of this standard. If, based on the information submitted in the request for interpretation, it is the opinion of the committee that the inquirer should seek professional assistance, the request for interpretation is not addressed with the recommendation that such assistance be obtained. Requests for interpretation that do not provide the information needed for the committee's full understanding shall not be addressed, and the inquirer is so notified.

C.2 Requirements

C.2.1 General

Requests for interpretation shall be limited strictly to interpretations of this standard (and not include interpretations of any normative references), or to the consideration of revisions to this standard on the basis of new data or technology. Requests shall be submitted in writing. Requests shall contain the name, address, and affiliation of the inquirer, and shall provide enough information for the committee to fully understand the point of concern in the inquiry.

Requests for interpretation of the standard should be directed to http://rfi.api.org.

Proposed revisions to the standard should be directed to standards@api.org.

C.2.2 Scope

Each request or interpretation shall be limited to only one single provision of the standard; however, the point of the inquiry may include two or more interrelated provisions as references or supporting information. The particular provision(s) shall be identified, including reference to the applicable edition, addenda, and errata.

C.2.3 Purpose of Inquiry

The purpose of the inquiry shall be stated. The purpose may be either to obtain an interpretation or to propose consideration of a revision to a particular provision in the standard.

C.2.4 Content

The inquiry should be concise, yet complete, to enable the committee to quickly and fully understand the point of the inquiry. Omit superfluous background information. The inquiry should be technically and editorially correct. If the point of the inquiry is to obtain an interpretation, the inquiry shall be stated in such a manner that the response to the inquiry is either "yes" or "no". The committee shall not address inquiries that pose questions of "how" or "why". If the point of the inquiry is to obtain a revision of the standard, the inquiry shall provide technical justification for that revision.

C.2.5 Proposed Reply

A request for interpretation may include a proposed reply, stating a believed interpretation of the requirements of the provision in question, or recommended wording for a revision.

C.2.6 Additional/New Proposed Processes

Processes other than those described in this document can be considered for inclusion in this standard. Persons who wish to have other processes included shall submit, at a minimum, the following information for the committee's consideration:

a) a description of the welding process;

b) a proposal on the essential variables;

c) a welding procedure specification;

d) weld inspection methods;

e) types of weld imperfections and their proposed acceptance limits;

f) repair procedures.

C.2.7 Response Time by the Committee

The committee shall review and provide a response to a request for interpretation as quickly as possible. The committee shall review the requests in the order they were received by API. However, since some responses may require input from several sources, a response may take up to one year to formulate and issue to the inquirer. The committee shall not accelerate this process to meet a deadline or schedule requirement of the inquirer. The inquirer should take into consideration this time frame.

For proposals of revision that are submitted, the committee shall determine the need for immediate change to inclusion in the document (an addendum) or if the revision may be delayed until the next overall edition of the document is published.

Bibliography

[1] API Recommended Practice 2201, *Safe Hot Tapping Practices in the Petroleum and Petrochemical Industries*

[2] AWS A5.01, *Procurement Guidelines for Welding and Allied Processes—Flux and Gas Shielded Electrical Welding Processes*

[3] BS 7910:2019, *Guide to Methods for Assessing the Acceptability of Flaws in Metallic Structures*

[4] Ferdinand Hurter and Vero Charles Driffield, “Photochemical Investigations and a New Method of Determination of the Sensitiveness of Photographic Plates,” J. Soc. Chem. Ind., May 31, 1890.

[5] Y.-Y. Wang and M. Liu, “A Comprehensive Update in the Evaluation of Pipeline Weld Defects,” U.S. DOT Agreement No. DTRS56-03-T-0008, PRCI Contract No. PR-276-04503, draft report to DOT and PRCI, November 2004.

[6] M. Liu, Y.-Y. Wang, and G. Rogers, “Stress Analysis of Pipe Lowering-in Process During Construction,” Proceedings of the 7th International Pipeline Conference, Paper No. IPC2008- 64630, Calgary, Alberta, Canada, September 29-October 3, 2008.

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[8] Y.-Y. Wang, M. Liu, D. Horsley, and G. Bauman, “A Tiered Approach to Girth Weld Defect Acceptance Criteria for Stress-based Design of Pipelines,” 6th International Pipeline Conference, Paper No. IPC2006-10491, Calgary, Alberta, Canada, September 25-29, 2006.

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[11] W. A. Bruce and W. E. Amend, “Guidelines for Pipeline Repair by Direct Deposition of Weld Metal,” WTIA/APIA Welded Pipeline Symposium, Welding Technology Institute of Australia, Sydney, Australia, April 3, 2009.

SPECIFICATION FOR CATHODIC PROTECTION

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CATHODIC PROTECTION SPECIFICATION FOR THE HLUHLUWE PHASE 2 – COMMAND RESERVOIR AND WATER RETICULATION UPGRADE, LOCATED IN THE MTUBATUBA LOCAL MUNICIPALITY, WITHIN uMkhanyakude DISTRICT MUNICIPALITY

FOR

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OCTOBER 2025

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CHANGE CONTROL TABLE

No.	Revision	Status	Date	Author	Description of the change
1.	00.01	New	25 October 2025	Zwonaka Engineering and Projects (Pty) Ltd	New
2.	00.02	Review 1			
3.	00.03	Review 2			
4.	01.00	Released			
5.					
6.					
7.					
8.					

DOCUMENT STATUS

No.	Status	Definition / Description
1.	New	New Document
2.	Reviewed	Document reviewed by author and management.
3.	Released	Document checked and released by the Quality Department. This document can only be modified if the version number is updated

VERSIONS

No.	Versions take place in two stages. Accepted documents receive the next higher integral version number.	
1.	00.01, 00.02 etc.	Not released versions, with the status “processed”.
2.	01.00	First released version with the status “released”.
3.	01.01, 01.02 etc.	Versions which supplement the version 01.00 and are “processed”.
4.	02.00	Second released versions with the status “released”.

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1. General

The project entails the design of the cathodic protection system for the Hluhluwe Phase 2 project which included the following pipelines:

- 355mm NB Gravity Main pipeline with approximate length of 6km
- 300mm NB Rising Main pipeline with approximate length of 3km
- 200mm NB Gravity Main pipeline with approximate length of 1.4km
- 200mm NB Reticulation main pipeline with approximate length of 1.6km
- 315mm NB Reticulation main pipeline with approximate length of 1.4km
- 90mm NB Gravity Main pipeline with approximate length of 1.5km

The pipeline will be coated externally using Three Layer Polyethylene (3LPE).

The scope of work includes Sacrificial Anode Cathodic Protection (SACP), and this document covers the specification for the CP only. Due to ongoing issues of vandalism in South Africa and CP infrastructure, it has recently been the intention to primarily use a Sacrificial Anode Cathodic Protection (SACP) System wherever possible. The pipelines will be protected by an SACP system. Hi-Potential Magnesium Anodes (10kg Bagged Mg Anode) was considered for the SACP Design.

The criterion for protection will be a polarised potential of -0.85 V versus a copper/copper sulphate reference electrode (CSE). The CP system has been designed for 20 years life.

2 Quality Control Plan and ITP's

The QCP, Method Statements and ITP's must be approved by the Engineer prior to the start of construction. The QCP must contain hold points for critical activities such as excavation, cable to pipe connections etc. Further work should not proceed until the Engineer has witnessed the particular "Hold Point.

3 Cathodic Protection

3.1 Hi-Potential Magnesium Anode Ground beds

A SACP system will be utilized to provide protection to the pipelines.

Seventy-six Magnesium Anodes Groundbed systems will be installed:

- The pipelines will be protected by a Mg Anode groundbed arrangement containing 6 x 10.0kg Hi-Potential Magnesium Anodes spaced as per the design document.
- The anodes cables will be terminated on the link panel inside the concrete bunker.
- The magnesium anodes will have red cable (16mm^2 PVC/PVC Red Single Core) attached to the anode and will terminate at the concrete bunker direct to the link panel.
- Two 16mm^2 PVC/PVC Black Single Core cables connected directly to the pipeline will be terminated at the link panel.
- Cable connection to the pipeline will be carried out utilizing a stud welding machine after which coating repair will be carried out.
- The magnesium anodes will be installed horizontally 3m from the pipeline, at the center of pipe depth, and spaced as per the design document. The magnesium anode will be bagged in a Gypsum / Bentonite / Sulphate mix.

The 10.0kg Hi-Potential Magnesium Anode composition is given in Table 1 below.

Table 1: Hi-Pot Mg Anode Composition.

Elements	Composition (% Weight)
Al	0.01% max
Mn	0.5-1.3%
Zn	Absent
Si	Absent
Cu	0.02% max
Ni	0.001% max
Fe	0.03% max
Other Impurities	0.3% max
Mg	Balance
Potential vs CSE	-1.75
Capacity (A.h/kg)	1200

3.2 Monitoring Bunkers

CP Monitoring Bunkers will be installed at 500m sections along the pipeline route as follows:

- Thirty-four 40 MPa Concrete Bunkers (with access doors) are to be installed along the pipelines. These Bunkers will be lifted using a crane & placed over the CP cables.
- A permanent reference electrode (PRE) and Coupon will be installed adjacent to the pipelines at the Bunker locations.
- 2 x 16mm^2 PVC/PVC Black Cables will be connected to the pipeline at each bunker location.
- The cables will terminate on a Chassis which comes with the bunker and link panel, which is mounted on a hot dipped galvanised steel stand.
- The cables from the pipe, anodes, PRE, and coupon will terminate on the link panel and IR Free Card.

  Bunkers must be placed on a concrete foundation. For the Bunkers the foundation must be at least 1200x1200x200 mm thick, containing steel mesh with a concrete strength of 25 MPa. The foundation must have a recess in the middle as shown in the drawings. 40 mm HDPE piping must be provided as ducts for the cables.
- A 50mm slotted HDPE pipe wrapped with Bidem must be inserted in the foundation as shown in the drawing. The soakaway is installed to assist with drainage of water
- The Engineer will provide the contractor with exact locations prior to the start of construction.

3.3 Continuity Bonding

Continuity bonding is to be installed at all fittings that may cause electrical discontinuity or high resistance. The details are as follows:

- Valve Chambers – Continuity Bonds to be installed around the outside of the chamber wall and backfilled. Cable to be two off 16mm^2 PVC/PVC copper.
- Buried fittings – Continuity bonding of buried flanges to be carried out. Cable to be two off 16mm2 PVC/PVC copper.
- At all cable attachments the coating must be repaired as per Section 3.7 below.

3.4 Reference Electrode and Coupon.

A long-life copper/copper-sulphate reference electrode must be installed 300 mm away from the pipe surface, at the 3 o'clock position and connected back to the IR Free Card. The reference electrode must have 5 m of cable.

A steel coupon, 32 mm in diameter, with 5 m of cable must also be installed next to the Permanent Reference Electrode.

3.5 Cabling

Copper-cored cables will be single or double insulated and rated for voltages up to 600 V/ 1000 V and shall possess stranded copper conductors in accordance with SANS 1507 or ASTM B-8.

Cables shall be buried at a minimum of 1.0 m below ground and shall be covered in concrete to avoid theft. The concrete must be allowed to dry sufficiently before the trench is backfilled with the soil material from the excavation. No cable markers will be required from a security perspective.

Cable details are provided in the table below:

Table 2: Cable Specification.

Description	Cores	Size	Type / Colour
Reference electrode (PRE)	1	6	BLUE
DC Coupon to Bunker	1	6	WHITE
Pipe to IR Free Card	1	16	DI / BLACK
Pipe to Link Panel	1	16	DI / BLACK
Anode to Link Panel	1	16	DI/ RED

All cable trenches must be witnessed by the Engineer, before the cables can be installed and covered in concrete, so this activity is a Hold Point on the relevant ITP.

3.6 Cable Connections to Pipeline

All cable connections to the pipeline shall be done using capacitive discharge welding (Stud Welding) so that no heat damage will be caused to the internal lining. Stud Welding to be done as follows:

- Coating to be removed at top of the pipelines (12H00 Position).
- Surface to be brushed with a steel wire brush (including surrounding coating (300mmx300mm).
- Area to be roughened using angle grinder fitted with flapper disk abrasion cleaner pad.
- All traces of existing coating (mastic etc.) or any other matter shall be removed from the surface.
- For 16 mm^2 PVC/PVC Copper Cable attachments remove 200mm x 150mm area of coating, area large enough for attaching Magnets on either side.
- Attach one magnet on either side making sure it is securely fastened.

- Insert stud into the chuck and make sure it is secured.
- Place chuck on weld area, hold firmly. Execute weld by squeezing trigger of chuck. Install two Studs per pipe.
- Remove electromagnets from pipe.
- Visually inspect the weld for uniform splatter. Tap weld lightly with hammer/rubber mallet.
- Remove 15 mm of insulation/sheathing from ends of cables. Crimp Lug to end of cables.
- Cable Lug to terminate on stud using 2 x M8 Washers and 1 x Loc-Tight M8 Nut (Washer-Lug-Washer-Loc-Tight Nut).
- Ensure there is some slack in cable.
- Photographic records of all installations to be done by the contractor.

The cable connections to the pipeline must be witnessed by the Engineer, prior to the coating being made good, so this activity is a Hold Point on the relevant ITP.

3.7 Coating Make Good at Cable Attachments

Coating repair at cable attachments to be done as follows:

- Clean cable attachment area (free from dirt and grease) with suitable solvent (Isopropyl Alcohol).
- Minimum ST 2 – Wire Brush.
- Existing pipeline coating cleaned to same size (300mm x 300mm).
- Existing coating to be “roughed-up” using sandpaper (300mm x 300mm).
- Apply Denso Primer D over stud weld/cable area and overlap with existing coating.
- Apply Denso Visco Mastic over the Stud & Cable to create a smooth profile and ensuring there are no gaps or air entrapment.
- Apply coating repair
- Photographic Record Required.
- Prior to backfilling the contractor must test the repair area using High Voltage holiday Detector. Contractor to provide name of equipment to be used.
- Each coating repair area to be tested to 15 kV.

3.8 Insulating Flanges

Insulating flanges will be installed at all required locations as per design document

C3.8 PARTICULAR SPECIFICATIONS

PVH 11 AIR VALVES

PVH 11.1 Design and Performance

The design and performance characteristics of the air valves must have been tested and approved by the Council for Scientific and Industrial Research (CSIR) or other similar testing authority.

Valves shall be capable of discharging high volumes of air through the large orifice under positive line pressure filling conditions and shall be capable of letting in high volumes of air under negative pressure conditions. In addition, the valve shall be capable of releasing small quantities of dis-entrained air at all line pressures up to the rated working pressure of the valve.

Air valves shall not exhibit the characteristics of dynamic closure in both the exhaust and vacuum mode. The valves shall be dual acting and suitably sized to enable the following without creating shock or pressure surges in the pipeline:

- Unrestricted intake of air under negative (sub atmospheric) pressure
- Unrestricted discharge of air under pressurised air pressure conditions and,
- Slow discharge of air that may come out of solution when the space beneath the air valve is full of water under pressure

The primary intake/discharge orifice shall be equivalent in cross-sectional area to the nominal diameter of the air valve. The discharge/intake port shall be protected by a non corrosive screen or shield that shall not impair the discharge characteristics of the valve.

Discharge of pressurised air shall be controlled by the seating and unseating of a small orifice nozzle which shall only open in the presence of air and shall not leak under normal operating conditions.

The valve construction shall be proportioned with regard to the inherent material strengths such that excessive deformation or damage of any kind or leaks do not occur when the air valve is subjected to twice its rated pressure.

Valves shall react immediately to negative pipeline pressure in order to prevent the formation of unacceptably high negative pressure conditions.

During air discharge conditions, the large orifice shall close at a differential pressure across the large orifice of between 4 and 6 kPa in order to minimize transient pressure effects. The design shall enable air to continue to be released once the large orifice has closed under such conditions. This may be achieved by means of a secondary orifice or other approved manner. A slow closing characteristic is an important feature so as to sudden rate of change of velocity which will result in a pressure spine and concomitant surges in the pipeline

The valve shall seal drop tight, without the use of a mechanical spring device, at all line pressures from 10 kPa up to 1,5 times the rated working pressure of the valve.

The valve floats and seals shall require minimal maintenance, and it shall be possible to carry out such maintenance without removing the valve.

Provision shall be made for the installation of a 6 mm stainless nipple and ball valve for the fitting of pressure gauges for testing purposes. The stainless-steel nipple shall extend through the body to cover all the threads.

Unless otherwise stated in Table G below, all ferrous components shall be treated as specified in PVH 3.3 above.

All stainless-steel components shall be painted with “Everbond” or similar material applied in accordance with the manufacturer's instructions, the purpose of which is to disguise the stainless steel to minimise the risk of theft.

All air valves shall be supplied with a copy of the relevant factory test certificates that reflect the test pressure and valve serial number. Original factory test certificates together with a copy of the QCP referred to in PVH 3.2 above, shall be issued for each valve.

Flange details are given in Table G below. The backs of each flange shall be spot faced over areas large enough to accommodate every washer and nut. All flanges are to be drilled with the holes off horizontal and vertical centrelines.

PVH 11.2 Testing

Each valve shall be tested at the factory as follows:

(a) Body Test: The valve shall be filled with water and a pressure equivalent to twice the 'Pressure Rating' shall be applied for at least 5 minutes. There shall be no visible signs of leakage during the test.

(b) Low Head Leak Test: The pressure shall be reduced to 50 kPa and maintained for at least 5 minutes. There shall be no loss of water from the valve during the test. Steadily lower the pressure further to ascertain at what pressure seepage begins and record that pressure.

(c) Drop Test: One valve taken at random from each batch of ten small orifice and
double orifice air valves (or less) shall be subjected to a "drop test". The valve shall be filled with water and pressurised to above the working pressure and isolated from the test rig by closure of an isolating valve. A chamber in the test rig immediately prior to the isolating valve must be filled with compressed air at a pressure equal to that being maintained in the air release valve. The isolating valve is then opened so as to allow the air to rise in the air release valve without the pressure dropping lower than 2 - 3 bar above rated working pressure of the air release valve. The "Drop Test" is then carried out by slowly bleeding off the pressure through a suitable cock until the float drops away from the orifice to allow discharge. Failure of the air release valve to function in the manner described will be reason for rejection.

Table G - Air Valves

	PN10	**PN16**	**PN25**	**PN40**
Flanges	SANS 1123: Table 1000	SANS 1123: Table 1600	SANS 1123: Table 2500	SANS 1123: Table 4000
Flange faces	Raised face	Raised face	Raised face	Raised face

C3.8.2 PARTICULAR SPECIFICATION: PWA – GROUND LEVEL RECTANGULAR PRESSED STEEL TANKS

The Contractor shall supply, deliver, erect, test, and commission **rectangular ground-level pressed steel water storage tanks** complete with all accessories and appurtenances, mounted on reinforced concrete plinths. The tanks shall be suitable for potable water storage and comply with all applicable South African Standards (SANS) and municipal requirements.

2. Tank Construction

- **Type:** Rectangular, ground-level, pressed steel sectional tank.
- **Panels:** Cold-formed pressed steel plates of standard modular sizes, hot-dip galvanized to SANS 121 (ISO 1461).
- **Plate Thickness:**
    - Base plates: ≥ 6 mm
    - Lower wall plates: ≥ 5 mm
    - Upper wall plates: ≥ 4 mm
    - Roof plates (if applicable): ≥ 3 mm
- **Sealing:** Butyl rubber or approved non-toxic sealant gaskets between plates, fixed with galvanized bolts, nuts, and washers.
- **Internal Coating:** Bitumen or epoxy lining, certified for potable water use, applied as per manufacturer's instructions.
- **Stiffeners:** Rolled steel angles/channels to reinforce wall panels; hot-dip galvanized.

3. Tank Capacity & Dimensions

- Nominal gross storage capacities:
  1Ml at Hluhluwe WTW
  4Ml at Command Reservoir Site
  4Ml at Mfekayi- Ward 21
- Dimensions: To be confirmed by the Contractor in consultation with the Specialist Supplier

4. Foundation and Plinths

- **Concrete Plinths:**
    - Reinforced concrete plinths (min. 600 mm wide) spaced to align with tank panel joints, constructed to Engineer's approved design.
    - Plinths to extend above surrounding ground level by at least 300 mm.
    - Concrete strength: As Specified in drawings
    - Reinforcement: High-yield deformed bars, placed as per structural drawings.
    - Plinths to be cast on a compacted hardcore/selected fill layer ≥ 150 mm thick.
    - Plinth surfaces finished smooth and level within ±5 mm tolerance.

5. Access & Ancillary Components

- **Access Ladder & Manhole:** Hot-dip galvanized mild steel vertical ladder to SANS 1308; lockable hinged manhole cover for top access.
- **Roof (optional):** Galvanized pressed steel or light aluminum roof sheeting with ventilators and overflow provisions.
- **Pipe Connections:**
    - Inlet, outlet, overflow and scour connections to be provided with flanged ends to SANS 1123.

    - Galvanized/MS flanged pipework inside tank as necessary.
    - Scour pipe to discharge via a screened, valved outlet away from the plinth.
- **Valves:** Gate or butterfly valves of approved make, flanged to match connecting pipework, with handwheels/gearboxes accessible at ground level.
- **Level Indicator:** Float-operated, externally visible level indicator with calibrated markings.
- **Overflow/vent screens:** Stainless steel mosquito-proof mesh to prevent contamination.

6. Structural & Hydraulic Design

- Tank panels and bracing shall be designed to withstand hydrostatic loads corresponding to full tank capacity plus 10% freeboard, as well as wind loads per SANS 10160.
- Design life: Minimum 25 years under normal operating conditions.

PWA 6 PIPEWORK

All pipework shall be manufactured in accordance with SANS 719 from 4.5 mm mild steel plate and shall be hot dipped galvanised to SANS 121 after fabrication. All inlet pipework is to be flanged with flanges to SANS 1123 Table 2500/3 with bolt holes drilled off-centre. All outlet, drain and overflow pipework is to be flanged with flanges to SANS 1123 Table 1600/3 with bolt holes drilled off-centre.

PWA 7 WATERTIGHTNESS TESTING

The tanks shall be filled to overflow level and left for 48 hours. Should there be any visible signs of leakage or any drop in the water level (other than that caused by evaporation) the Contractor shall search for and remedy the defects.

PWA 8 MEASUREMENT AND PAYMENT

The Contractor shall factor in the costs of the above when pricing for the Reservoirs

PWA 8.2 Supply

Supply and deliver stand and tank and all appurtenances

to site.
.....
..... Unit: Sum

PWA 8.3 Erection

Erection of tank and stand and all appurtenances.
..... Unit: Sum

C3.8.3 PARTICULAR SPECIFICATION: PAA – DAYWORKS SCHEDULE

PAA 1	General	C3.229
PAA 2	Salaries and Wages of Workmen	C3.229
PAA 3	Constructional Plant	C3.229
PAA 4	Materials	C3.230
PAA 5	Measurement and Payment	C3.230
PAA6	EPWP	C3.231

C3.8.3 PARTICULAR SPECIFICATION : PAA - DAYWORKS SCHEDULE

PAA 1 GENERAL

In cases where the Employer's Agent orders any variation in the form, quality or quantity of the work or any extra work to such an extent that the tendered rates for specific items are no longer applicable, or where a combination of tendered rates cannot be applied to compensate for such work, the Employer's Agent may, in terms of the General Conditions of Contract, order that the amended or extra work be carried out as daywork at the cost of labour, plant and materials. For that purpose provision is made for the Contractor to tender his rates for labour and plant in the Daywork Schedule which forms part of this contract.

No work will be measured as daywork unless:

(a) the Employer's Agent agrees that the varied work is not in accordance with the specification or scope of a measured item in the contract.

(b) the Employer's Agent has issued an order in writing for the execution of such varied work; and

(c) statements of plant and labour are submitted daily to the Employer's Agent for his consideration and approval.

All work valued at the tendered rates in the Daywork Schedule will be subject to contract price adjustment as applicable to the Contract.

PAA 2 SALARIES AND WAGES OF WORKMEN

The amount to be paid for labour will be based on the rates tendered in the Daywork Schedule for the workers executing the work. The tendered rates shall be all-inclusive and shall be held to cover all charges for the Contractor's profits, timekeeping, clerical work, insurance, establishment, superintendence, the use of hand tools, etc, and no additional surcharge over and above the tendered rates will be applicable.

PAA 3 CONSTRUCTIONAL PLANT

The rates for constructional plant as tendered in the Daywork Schedule shall cover all costs, overheads and profit for the contractor and no further surcharge will be payable on the tendered rates. The cost of operators shall be included in the tendered rates except where otherwise specified in Clause PSAA 5 (Measurement and Payment) hereafter.

Where plant or equipment for which no rates exist in the Daywork Schedule are employed, the cost thereof shall be determined as agreed with the Employer's Agent in terms of the General Conditions of Contract. In such case contract price adjustment will only be applicable if the agreed cost is based on rental rates at the time of the base month before closing of tenders, or if the ruling rates current at the time of the execution of the work are de-escalated to the base month.

The Contractor will be paid for the transport to and from the site of constructional plant not on site and specially ordered by the Employer's Agent to be brought on site. No payment will be made for transport of

equipment listed in the Contractor's Schedule of Constructional Plant in the tender document, or for equipment which has been removed from the site on request of the Contractor, or for equipment already on site, regardless of whether it appears on the Schedule of Constructional plant or not.

PAA 4 MATERIALS

Materials required for daywork items which cannot be compensated under existing rates and have to be purchased, will be paid for at cost, excluding VAT, plus a surcharge of 15%. The cost of materials provided for daywork at current rates at the time when the work is executed, will not be subject to contract price adjustment unless the prices of the materials are de-escalated to the base month for escalation.

PAA 5: MEASUREMENT AND PAYMENT

Item Unit

PAA 5.1 Labour

(a) Unskilled workers ..... /hour (h)

(b) Skilled workers (Artisans) ..... /hour (h)

(c) Operators and drivers (where measured separately) ..... /hour (h)

(d) Foremen ..... /hour (h)

(e) Others (specify) ..... /hour (h)

The unit of measurement is the hour or part thereof during which workers were engaged in daywork.

The tendered rate shall include full compensation for all salaries, wages, bonuses, pension, insurance, medical aid and other benefits as well as overheads arising from administrative personnel, site agents, supervisors, tools and profit. No surcharge will be paid on the tendered rates

The cost of operators included in the rates for constructional plant, will not be measured again under Labour.

PAA 5.3 Cost of materials delivered to site (specify) ..... Provisional sum or as scheduled

The unit of measurement for sub-items 5.2(a) to (e) is the hour or part thereof during which the item of plant had been in active use for the daywork operation, including stopping time of less than five minutes.

Where applicable travel time to and from the normal parking position on site, or the position of the most recent non-daywork activity, as well as stopping time exceeding five minutes shall be multiplied by a factor of 0,6. Time shall be measured by means of a vibrating clock card.

The unit of measurement for sub-item 5.2(f) is the kilometre travelled to collect or transport small quantities of materials. Kilometres travelled in light delivery vehicles by supervisors in the execution of normal supervision duties, shall not be measured for payment.

The tendered rates shall include full compensation for the supply, maintenance, service, repairs, depreciation as well as fuel, lubricants, licensing, insurance, overheads and profit. It shall also include the cost of drivers and operators except in the case of sub-item PAA 5.2(c) and (d) where the operators of tools are paid for under labour.

C3.8.4 PARTICULAR SPECIFICATION: PT - TRAINING

C3.8.4PARTICULAR SPECIFICATION: PT - TRAINING

PT1 INTRODUCTION

PT1.1 Scope

This specification covers Accredited On-Site Skills Training for nominated trainees from the local community in skills relating to specific areas related to construction. It is intended that candidates for training will be people who are undergoing, or who have undergone, training at a University of Technology or FET College. Training is described in section C3.5.10.

PT2 EMPLOYMENT ARRANGEMENTS

The Employer will inform the Contractor of the number and names of candidates to be trained and confirm the categories of training to be provided (see PT4 below) and the required timing (date for start of training and duration). The Contractor shall proceed to timeously employ such candidates for the duration of training and shall claim for salary and other validated costs incurred, including agreed mark-up, according to the Training Schedule. The trainees shall be employed according to the Contractor's full and normal conditions of employment for unskilled labour, including registration for Workmens' Compensation.

The trainees shall fall under the Contactor's Health & Safety Plan for the duration of training. However the trainees will not be available for deployment by the Contractor for the duration of training. Upon completion of training the employment contract with each trainee will cease and the Contractor shall have no obligation towards the trainees in respect of further employment. The Contractor may, however, employ the trainees on permanent, or other basis, on terms to be mutually agreed.

PARTICULAR SPECIFICATION: PEPWP: CONDITIONS AND SPECIFICATION

EPWP CONDITIONS AND SPECIFICATIONS

Employment Targets

The contractor needs to provide a realistic estimate on the number of jobs that the project has the potential to create throughout the project duration as the project will be implemented using Labour Intensive Construction methods on elements where it is economical and feasible for this construction method.

No of jobs to be created = a minimum of **80 or more people** are to be employed over the duration of the project

Employment requirements

Tenderers are advised that this contract will be subject to the Expanded Public Works Program (EPWP) aimed at alleviating and reducing unemployment.

Tenderers must allow for any costs for the following employment requirements of the EPWP:

1. 55% of unskilled labour to be women;
2. 40% of unskilled labour to be youth aged between 18 and 35 years; and
3. 5% of unskilled labour to be people living with disability.

100% unskilled labour utilized must reside within the boundaries of the Municipality ward where this contract is executed, with preference to the local community closest or at the walking distance to the contract site. Wherever possible local skilled tradesmen are to be employed on this contract with the view to maximize utilization of local resources.

Labour rate and payment intervals

The contractor should ensure that labour rate paid to unskilled local labour is commensurate to the daily task. When determining the rate, consideration should be given to that EPWP beneficiaries are mostly bread winners in their families, as the program intends alleviating poverty. There should also be consideration that the labour rate promotes creation of expanded number of jobs created and person days of work.

Contractors should make endeavours to ensure that labourers, particularly unskilled are remunerated on fortnight basis and prior notification be made should there be a shortfall on their wages.

The labour rate for local unskilled shall also be determined in consideration of the location of the project, i.e. for projects implemented in urbanized municipalities will not be the same as that for rural municipalities, but the rates to be used must be the prevailing rates as gazetted by the Department of Labour or SAFCEC whichever is the greater.

Labour Intensive Construction (LIC) method

On site there must be a person(s) having competency in managing and implementing LIC methods.
*Foreman @ NQF Level 4 the Unit Standard on Implementing LIC methods on site.

*Site Agent/ Managers @ NQF level 5 the Unit Standard on Manage Labour- Intensive Skills Programme both must be CETA accredited

Labour Intensive Construction Method

Those parts of the contract to be constructed using Labour Intensive methods will be marked in the BoQ with letter LI (indicating Labour Intensive) against every item so designated. Such works will only be constructed using method so indicated.

Reference to be made to Guidelines for the implementation of Labour Intensive Infrastructure projects under EPWP.

"Scope of Work in Respect of Work Relating to the Expanded Public Works Programme (EPWP)".

Record Keeping

Every employer must keep in the project site office the site progress minutes; contractors' monthly site progress reports; accurately recorded attendance register; proof of payment as means to verify authenticity of data in the EPWP Beneficiary form submitted with payment certificates. Copies of submitted EPWP beneficiary data forms should also be kept in the site office.

The employer must keep this record for a period of at least three (3) years after the completion of the project in his/her office as the project site office would have been relocated.

This should be safely kept for job creation data verifications and periodical audits on projects conducted by National and Municipality after one (1) or two (2) quarters of submitting captured EPWP Data to the National EPWP coordinating Department.

EPWP Reporting as per EPWP data form

At the end of each month as part of site progress report and to be attached to every contractors' progress payment certificate; the contractor shall provide the principal agent with a written record, as per EPWP data form; which will be reflecting, beneficiaries full name & surname; ID No and job description of labour employed by main contractor and sub-contractors on site.

NOTE:

- Apon Contract award, the Municipality will issue data collection tool that needs to be completed and submitted to the Municipality on the 5th day of every month
- All details of the contract must be captured in full on the data collection tool (under registration form and business form sections)
- Beneficialry information must be accurately captured onto the data collection tool, that is, idenity numbers, names, etc (under beneficiary information section)
- The payment upload on the data collection tool must be updated on monthly basis by the Contractor
- Certified copies of identity documents of each employee must be scanned, named and e-mailed to the EPWP official of the Municipality
- Should an employee be laid-off the contract, this must be captured next to that particular employees name.

EPWP Promotion/Signboards

EPWP Program at the project level shall always be promoted through having the projects signage board that embrace EPWP logo at the bottom, correct measurement for this signage board will be provided by the project leader during the site handing over meeting.

Contractor & Sub-contractors' labourers shall be provided with EPWP branded Personal Protective Equipment (PPE), reflector vest with EPWP wording at the back is an ideal and cost-effective means of promoting program on site.

The contractor is then advised to price for both items above.

COMMUNITY LIAISON OFFICER (CLO)

UTILISATION OF A COMMUNITY LIAISON OFFICER

The Contractor shall allow for and pay any and all costs necessary for the engagement of the services of a Community Liaison Officer (CLO) for the full duration of this contract.

A CLO will be identified by the local structures of the ward areas and appointed following fair and transparent interviewing process, to be conducted in the presence of local structures and the contractor representative, in order to assist the Contractor in the procurement of any local labour, etc. required for this project. The Contractor is to liaise with the CLO and afford him any assistance needed in ensuring sound working relations with the local community.

Key Responsibilities of the CLO are envisaged to include and not necessary be limited to:

1. Assisting local leadership in conducting skills and resources audit which facilitates sourcing labour from within the ward or targeted areas for employment, as required by contractor.
2. Assisting in sourcing labour-only domestic sub-contractors and the procurement of materials from local resources, as required by the contractor.
3. Assisting the contractor by identifying areas of potential conflict and or threats to the project or to stakeholders in the project and recommend appropriate action to the contractor.
4. Assisting contractor and stakeholders in the project in the resolution of any conflict which may arise.
5. Establishing and ensuring that sufficient and open communication channels between the contractor and the work force are maintained.
6. Establish and ensuring that efficient and open communication channels between the contractor and the community are maintained.
7. Identifying and reporting to the Contractor regarding issues where communication between stakeholder is necessary, recommend courses of action and facilitate such communications.
8. Assisting the Contractor and the work force in the establishment of grievance procedures and necessary recommendation to the Contractor regarding the grievances and solution thereto.
9. Attending to site meetings and project implementation meetings as required by the Contractor and prepare periodic reports as may be required by the Contractor from time to time.
10. Attending to such other duties which are consistent with the functions of a CLO, as may be required by the Contractor from time to time.

Tenderers are to price twice the rate of unskilled local labour rate against this item for any and all costs arising out of compliance with the foregoing and in the event of a Tenderer failing to price against this item or making inadequate financial provision against this item for compliance as aforesaid, then no claim for costs or additional cost incurred will be entertained.

Skills development on site

Contractor in conforming to the object of EPWP that its beneficiaries need to be capacitated with skills that will render them employable in the future. It is then the responsibility of the contractor that mandatory life skills are provided to 100% of workforce on site and on the job training to labourers from whom the potential for further development has been identified. The latter is not mandatory to all as it covers technical skills.

Contractor should also make provision for the possibility that there might be local youth that will need to be placed on the project with an intention to be provided support towards improving their level of competency and productivity.

Contractor shall also provide all necessary on-the-job training to targeted labour to enable such labour to master and advance on techniques required to undertake the work in accordance with requirements of the contract in a manner that does not compromise workers' health and safety.

Labour Only Sub Contracting for local emerging enterprises

Tenderer's are advised that this contract is subject to the Expanded Public Works Programme (EPWP) and the following criteria will apply:

African Equity Ownership

a) The Tenderer is to allow for 5% of the total value of works to be undertaken by a Priority Population Group. This percentage excludes the costs of employing local unskilled labour. The allocation of this percentage from the Project, the screening of people, the selection of skills, will be for the Contractor to adjudicate.

b) The Priority Population Group consists of women, youth and disabled people.

c) The Contractor is to give first option for prospective PPG's from the surrounding areas of the Project. Should there be insufficient suitable people fitting the criteria of PPG's, the Contractor may hire people from further afield. This is to be done only after consultation with the ISD EPWP Co-ordinator and the Community Liaison Officer (CLO),

d) A Mentor with health and safety skills is to be employed by the Contractor, in consultation with the ISD for the purposes of quality control and liaison between the Contractor and the selected PPG's on site. The mentor will be responsible for ensuring an acceptable level of quality workmanship and that such work carried out by the PPG's is executed within the time frames stipulated.

In so far as possible, the Contractor is encouraged to expand the PPG's skills, knowledge and performance levels.

TENDERER'S TO NOTE CONDITIONS

(a) The contract to be entered into between the Contractor and the PPG's will be a LABOUR ONLY sub-contract.

(b) The Contractor will be responsible for ensuring that all materials for use by the PPG's in the works are to be on site timeously. The Contractor shall liaise with the Mentor and PPG to determine the nature and extent of materials required and the lead time necessary.

(c) The Contractor shall be responsible for the overall programming of the Works and he is to allow for monitoring the PPG's programme and progress.

(d) In conjunction with the Mentor, he is to allow for the supervision and mentoring (where necessary) of the PPG to ensure quality and adherence to standard building practice.

(e) The Contractor is to allow for extra storage facilities on site for the PPG's tools and equipment.

(f) Basic tools shall be provided by the PPG's and where these are not available; the Contractor will supply him/her with the necessary tools and equipment and deduct the costs thereof from the interim claims made by the PPG.

(g) Work requiring specialized tools, tools will be provided free of charge by the Contractor with the provision that these be returned upon completion of the Work.

CO-ORDINATION

The Contractor is to co-ordinate the work of all the PPG's, Sub-Contractors and Nominated Sub- Contractors appointed direct by the Employer in such a manner and at all times as will suit the building programme and he is to allow adequate access, for the PPG's, where required, to carry out their work in an efficient manner as no claims for extras in this connection will be entertained.

ATTENDANCE

The Contractor may allow for attendance upon the PPG's concerned to execute the work. The Contractor is to allow the PPG's the use of any scaffolding belonging to him while it remains so erected on the site.

Where scaffolding is necessary for the use by any PPG and the Contractor has not erected any for his own use or has removed same after his own use, the Contractor shall supply sufficient scaffolding to the PPG to be erected and dismantled by the PPG and returned to the Contractor.

This attendance upon PPG's to execute the work is to include for the scaffolding provisions as aforesaid and, in addition, is to include for co- operating to the fullest extent with all the parties, attending on off-loading materials, providing suitable storage for tools and materials used by the PPG's, use of general facilities such as latrines, etc., supply and cost of power, lighting, water and the like.

EPWP contract for labour

It is compulsory that shortly after the contractor and or sub-contractor has appointed local labour, the employment contract should be signed by both parties, prior to commencement with works on site. The employment contract forms part of the Ministerial Determination or from the regional EPWP officials.

EPWP Scope of Work

Note:
Contractors are to price any item on the Bill of Quantities having below, bearing in mind that they are regarded as main sources of job creation, whether subcontracted or undertaken by the main contractor.

Elements on the scope of work where application of Labour-Intensive Construction methods as will be indicated with letters (LI) are regarded feasible are as follows:

i) Excavating trenches for foundations and any other civil works with the depth not more than 1.5 m ii) All masonry works which include concrete mixing on site; brickwork; plastering; screed works; jointing; etc.
iii) Painting, Plumbing, Ironmongery; roof cladding; glazing; tilling; carpentry; flooring; waterproofing; etc. iv) External works such as landscaping; cleaning; paving; fencing; tarmac; etc.

Note

It is a general requirement of this contract that persons normally reside in the ward of the works (local labour) be given preference for employment on the contract. Provided, however, that **should adequate and appropriate labour not be available within the ward**, others may be employed subject to satisfactory proof being provided that every reasonable endeavour has been made to employ local labour **(Local Sub-contractor(s); Skilled; Semi- Skilled and Unskilled).** The contractor shall in consultation with the local community leaders with the purpose of negotiating with them regarding the utilization of local resources in the construction process. In this regard, the contractor shall furthermore give preference, wherever possible to the employment of single heads of households, women and youth as well as families declared as most indigent by War on Poverty/ Sukuma Sakhe program profiling process. The contractor should aim, in general, to maximise the involvement of the local community, however workers from other communities should not exceed 20% of all persons working on the project, where local employees possess skills at level of competency that meet contractor's requirements.

C3.8.6 PARTICULAR SPECIFICATION: PE – THE EMPLOYERS PRE-CONSTRUCTION HEALTH AND SAFETY SPECIFICATION

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PE1 Introduction

This Health and Safety Specification has been prepared in terms of the Client's responsibility [Construction Regulation 5 (1) (b)] to provide the Principal Contractor and Contractors with a documented Specification of all Health and Safety requirements pertaining to the associated works on the proposed construction site/s, so as to ensure the Health and Safety of all persons affected by the construction activities. This Health and Safety Specification highlights, but in no way replaces, the legal requirements that the Principal Contractor and Contractors are bound to comply with in terms of the contract.

- The client has made provisions in the tender for the Principal Contractor to price for the cost of Health and Safety Measures before and during the construction process [Construction Regulation 5 (1)(g)]. The Principal Contractor, in turn, needs to make the same provision when Contractors (Sub-contractors) tender or quote on work [Construction Regulation 7 (1) (c) (ii)].

- The Principal Contractor and Contractors are required to prepare a Health and Safety Plan based on the Client's Health and Safety Specification including other legal requirements applicable to their business, which shall be applicable from the date of commencement of and for the duration of the work [Construction Regulation 7 (1)(a)]. This documented plan must be based on a Hazard Identification and Risk Assessment (HIRA) which will serve to identify the hazards, and their associated risks, anticipated for the scope of works [Construction Regulation 9].

Principal Contractors tendering must provide the Client with an appropriate Preliminary Health and Safety Plan (including a Preliminary Hazard Identification and Risk Assessment) as in Construction Regulation 7 and 9. This Plan must be submitted with the tender.

PE2 Purpose

The purpose of the Health & Safety Specification is to provide the Principal Contractor and Contractor's tendering for the proposed construction work, and/or appointed for the above mentioned construction work with the necessary detail of all the health and safety requirements pertaining to the associated scope of works, so as to enable the Principal Contractor and Contractors to develop their Health and Safety Plans to be implemented on site with a purpose of ensuring the health and safety of all persons, property, equipment and other persons that may be affected by construction activities.

PE3 Application

The H&S Specification contains clauses that are applicable to occupational health and safety in construction and the document is intended to impose pro-active controls associated with the activities, plant & machinery and other aspects of the proposed construction work that impact on health and

safety of persons, by means of a documented H&S Plan prepared by the Principal Contractor and Contractors.

Compliance to the requirements of the OHSAct and relevant legislation is in addition to the requirements of the H&S Specification and forms part of the Principal Contractor's and Contractor's responsibility. The Client and Client's Agent will monitor the Principal Contractor to ensure that the Principal Contractor and Contractors comply with the requirements of the OHSAct & other legal requirements and will not prescribe to the Principal Contractor how such compliance is to be achieved.

PE4 Definitions

The following definitions apply.

For the purpose of the General Health and Safety Specification, the abbreviations or definitions given hereunder shall apply:

"CR" refers to the Construction Regulations, 2014

"GHSS" refers to this document (the General Health & Safety Specification) including any project specific annexures that the engineers and designers could attach.

"OHSA" refers to the Occupational Health &Safety Act of 1993

"S" refers to a Section in the Occupational Health & Safety Act of 1993

"H&S" refers to Health and Safety

"Client" uMkhanya Kude District Municipality

Incident: means any unplanned event that causes, or has the potential to cause, an injury or illness and/or damage to equipment, buildings, plant or the natural environment. Incidents range from nearmiss incidents to serious incidents and emergencies.

"Near Miss" means an incident which has the potential to cause an injury or illness or damage to company property.

"Regulations" means, specifically, the Construction Regulations, 2014 as issued on 7 February 2014, under the Occupational Health & Safety Act of 1993, but not excluding the other applicable regulations existing under the Act.

"Site" means the lands and other places, made available by the Municipality or the Client for the purposes of the Contract, on under over in or through which the construction work is to be executed or carried out.

"Principal Contractor" and "Contractor" shall be as defined in the Regulations.

Construction Work [CR 1]: Means any work in connection with –

- The erection, maintenance, alteration, renovation, repair, demolition or dismantling of or an addition to a building or any similar structure.
- The installation, erection, dismantling or maintenance of a fixed plant where such work includes the risk of a person falling.
- The construction, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; or
- The moving of earth, clearing of land or making of an excavation or work on any similar type of work.

Hazard Identification, Risk Assessment and Risk Control (HIRA)

Means a documented plan, which identifies hazards, assesses the risks and detailing the control measures and safe working procedures, which are to be used to mitigate and control the occurrence of hazards and risks during construction or operation phases.

Site

Means the area in the possession of the Contractor for the construction of the works. Where there is no demarcated boundary it will include all adjacent areas, which are reasonably required for the activities for the Contractor and approved for such use by the client.

Hazard

Means a source of or exposure to danger (source which may cause injury or damage to persons or property)

Risk

Means the probability or likelihood that a hazard can result in injury or damage.

Construction Manager [CR 8(1)]

Means a full time, competent employee appointed in writing by the Contractor to supervise construction work. The appointment, as required by the OHSA, shall stipulate health and safety responsibilities, area of responsibility and the proposed duration of the project.

Hazardous Chemical Substance (HCS)

Means any toxic, harmful, corrosive, irritant or asphyxiant substance, or a mixture or substances for which an occupational exposure limit is prescribed, or an occupational exposure limit is not prescribed, but which creates a hazard to health.

Construction Plant

Encompasses all types of plant including but not limiting to, cranes, piling frames, boring machines, excavators, dewatering equipment and road vehicles with or without lifting equipment.

Contractor [CR 1]

Means an employer [OHSA 1] who performs construction work and includes principal contractors and sub-contractors.

Health and Safety Plan (HSP) [CR 1]

Means a documented plan, which addresses hazards identified and includes safe work procedures to mitigate, reduce or control the hazards identified.

The plan shall be applied from the date of commencement of and for the duration of construction work [CR 5(1)]

Health and Safety File (HSF) [CR 1]

The file holding all documentation and records on health and safety for the project, which shall be available at all, times for evaluation, and a copy of which will be forwarded to the client upon completion of the project.

Disabling Injury Frequency Rate (DIFR)

The number of disabling injuries (DI's) multiplied by a constant (man hours relative to period worked) divided by total man hours worked over a rolling period (usually 12 months, but can be less)

Disabling Injury Severity Rate (DISR)

The number of days lost due to DI's multiplied by a constant (man hours relative to period worked) divided by total man hours worked over a rolling period (usually 12 months, but can be less)

Confined Space

An enclosed, restricted or limited space in which, because of its construction, location or contents, or any work carried on therein, a hazardous substance may accumulate, or an oxygen deficient atmosphere may occur, and includes any chamber, tunnel, pipe, pit, sewer, container, valve, machinery or object in which a dangerous liquid or dangerous concentration of gas, vapour, dust or fumes may be present.

PE5 Compliance

- The Principal Contractor and other contractors must establish, implement and maintain a system for identifying and accessing the legal and other health and safety requirements that are applicable to their organisation.
- The Principal Contractor and other contractors shall ensure that these applicable legal and other requirements to which their organisation subscribes are complied with when establishing, implementing and maintaining their system, and when doing their construction activities. legal requirements referred to are legal requirements such as
    a. Occupational Health and Safety Act, number 85 of 1993 and its regulations as amended,
    b. Compensation for Occupational Diseases Act, number 61 of 1997
    c. Including all legal and other requirements to which the organisation subscribes.
- All information regarding legal and other requirements must be kept up to date all the time.
- The Principal Contractor and other contractors must communicate relevant information on legal and other requirements to all stakeholders.

PE6 Site Rules for Contractors

The site rule for contractors is the minimum standard with regard to specifications for construction work on this site. Contractors may have existing standards for each specific trade, but where conflict may arise between the contractor's standards and these Site Rules for contractors, the more stringent shall apply.

PE6.1 Rules of Conduct

Contractors and all employees under their control, including any visitors brought onto site must adhere to the following Rules of Conduct on Site:

Conduct Not Permitted: -

- No persons shall partake of, possess or sell drugs or alcoholic beverages on Site. Any employee or visitor whose actions and demeanour show symptoms of possible narcosis or drunkenness shall be removed from site.
- Indulge in practical jokes, horseplay, fighting or gambling.
- Make use of water from fire hydrants
- Destroy or tamper with safety devices, symbolic signs or wilfully and unnecessarily discharge fire extinguishers.
- Bring onto site or have in your possession of a firearm, lethal weapon, camera, or any other recording device, unless authorised to do so.
- Assault, intimidate or abuse any other person.

- Operate construction equipment (vehicles or plant) without the necessary training/competency and authorisation.
- Display insubordination toward any supervisor, foreman or manager in respect to carrying out of properly issued instructions or orders for health and safety reasons.
- Enter into any areas where you have no business unless authorised to do so by the person in charge
- Negligently, carelessly or wilfully cause damage to property.
- Refuse to give evidence or deliberately make false statements during investigations
- Bring animals onto site.

Insubordination towards any foreman, supervisor or manager could lead to removal from site and/or dismissal and/or prosecution. Except insofar as the principles of common law, or conditions as determined by any relevant statutes are concerned, the decision of the Client or his Agent shall be final and binding in respect of any disputes that may arise from the interpretation of these rules.

PE7 Responsibilities of Contractors for Construction Work

PE7.1 Notification of Construction Work [CR 4]

Before construction work commences, the contractor shall notify the Provincial Director of the Department of Labour in writing if the construction work shall: -

- Include excavation work
- Include working at height
- Include demolition of a structure
- Include the use of explosives to perform construction work

PE7.2Duties of Principal Contractor's [CR 7]

The contractor must: -

8.2.1. Compile a suitable, sufficient, and coherent site-specific health and safety plan [CR 7(1a)

8.2.2. Keep on site a Health and Safety File with all required documents (CR 7 1b).

8.2.3. Ensure sub-contractors are appointed in writing, registered with COIDA and have necessary competences and resources to perform construction work safely.

8.2.4. Ensure all employees have valid medical certificate of fitness specific to the construction work performed and issued by an occupational health practitioner in a form of Annexure 3.

8.2.5. Ensure co-operation between all contractors [CR 7(4)] to comply with the Act.

8.2.6. Ensure compliance with the Act in terms of [CR 5(3)]

a. Provide relevant sections of these specifications to contractors as required

b. Appoint each contractor in writing and only appoint contractors who have the necessary competencies and resources may be appointed [CR 7(1) (v)]

c. Ensure each contractor's HSP is implemented and maintained throughout the duration of the project on site

d. Stop any contractor from work which is not in accordance with HSP / law, or which pose a threat to health and safety of persons.

e. Sufficient information is provided to contractors where there are changes to design and construction.

f. Ensure every contractor is registered and in good standing with the Compensation Commissioner

g. Ensure potential contractors have made provision for the cost of health and safety measures

8.2.7. Negotiate and approve the HSP of each contractor [CR 7(1) (vi)

8.2.8. All HSP's including the principal contractor's to be available on site [CR 7(1)]

8.2.9. All HSF's including the principal contractor's to be available on site [CR (7)]

8.2.10. A consolidated HSF to be handed over to the client on completion of construction including records of drawings, designs etc. [CR 7(1) (e)]

8.2.11. HSF to include updated list of all contractors, the agreements and their type of work [CR 7(1) (f)]

PE7.3Contractor's Responsibilities [CR 7(2)] (including sub-contractors)

8.3.1. Provide their HSP to the principal contractor [CR 7(2)(a)]

8.3.2. Where a contractor appoints another contractor (sub-contractor) it is the responsibility of that contractor to apply sub regulation 1(b) to(g) of CR 7 as if he were the principal contractor [CR 7(3)]

8.3.3. No contractor to appoint another contractor (sub-contractor) unless the latter has the necessary competency and resources to perform the required work

8.3.4. To provide any information which affects the health and safety of any persons at work to the principal

contractor [CR 7 (2) (e)]

PE7.4 Legal Appointments

The principal contractor shall ensure copies of the appointment letters of all responsible persons appointed on site will be kept in the HSF. All legal appointments shall be conducted in accordance with the requirements set out in the OHSA and as per this specification. The tables below set out the

appointment protocols for CR and OHSA. It should be noted that these represent complete lists and not all these appointments may be required:

PE7.4.1 Construction Regulation Appointments

Reg.	Appointment	Appointee	Appointed by
CR 5 (1)(k)	Principal Contractor	16(2) for the company	Client
CR 7 (1)(v)	Contractor	Competent person	Principal Contractor
CR 8 (1)	Construction manager	Competent person	Principal Contractor
CR 8 (2)	Assistant Construction manager	Competent person	Principal Contractor
CR 8 (5)	Safety Officer **SACPCMP registered**	Competent person	Principal Contractor
CR 8 (7)	Construction Supervisor	Competent person	Principal Contractor
CR 8 (8)	Assistant Construction Supervisor	Competent person	Principal Contractor
CR 9(1)	Risk Assessor	Competent person	Principal Contractor
CR 11 (2a)	Structure Inspector	Competent person	Principal Contractor
CR 13 (1)	Excavation Work Inspector	Competent person	Principal Contractor
CR 21 (1k)	Construction Vehicle Inspector/ Mobile plant Operator	Competent person	Principal Contractor
CR 28 (a)	Stacking and Storage Supervisor	Competent person	Principal Contractor
CR 29 (h)	Fire Equipment Inspector	Competent person	Principal Contractor
CR 29 (i)	Fire Team Members	Competent person	Principal Contractor

OHS Act Appointments and other relevant Regulations

Reg.	Appointment	Appointee	Appointed by
OHSA 16 (2)	16 (2)	Contract Manager	16(1)
OHSA 17 (1)	Health & Safety Rep	Elected / Nominated	16(1)
GAR 9 (2)	Incident Investigator	Competent person	Principal Contractor
GSR 3 (4)	First Aider	Competent person	Principal Contractor

The responsibilities of each appointment are detailed in the relevant form, which are signed by both the authorised person and the appointee and kept in the Health and Safety file.

PE8 Documentation and Procedures

All required HSE documentation for the construction work, shall be kept in the HSF, which shall be available on site. The Construction Supervisor shall be responsible for the file on site and the Project Manager shall ensure that documentation is valid and up to date. The procedures to be used for the project are to be in accordance with contractor policy and as per the outcome of the HIRA exercise. It is required that the documentation is filed in an orderly fashion for easy access. The following sections are suggested:

- Policies, permits, notifications etc.
- Health & Safety plans, specifications
- Appointments
- Incident management
- Inspection checklists
- Risk assessments
- Training
- Safe Work Procedures
- Hazardous Chemical Substances
- Medicals
- Audit reports

PE9 Application of COIDA and OHSA to Construction Work

[Items 8.11 to 8.15 only may not be applicable]

PE9.1 Compensation of Occupational Injuries and Diseases Act, Act No. 130 of 1993 (COIDA)

Every contractor shall provide proof of registration and a valid letter of good standing with the Compensation Commissioner.

PE9.2 Occupational Health and Safety Policy [OHSA 7]

The contractors must develop a Health and Safety Policy that: -

- Is appropriate to nature & scale of risks,
- Includes commitment to prevent injuries & ill health, and continual improvement of health and safety performance,
- Includes the commitment to comply with applicable legal and other requirements,
- Includes the setting of health and safety objectives and targets,
- Is documented, implemented and maintained,
- Is communicated to all stakeholders,
- Is reviewed periodically to ensure its relevant and appropriate to the construction company.

PE9.3Health and Safety Training and Competency

A training needs analysis must be developed, and training provided for all persons requiring training. Proof of training / competency must be made available on file.

PE9.3.1 Induction Training

The principal contractor shall be responsible for the induction of all personnel entering the site including visitors, inspectors etc. Contractors doing specific construction work shall be responsible for the induction of their employees with respect to that specific work. Records to be kept on file for all personnel that undergo induction training.

PE9.3.2 Awareness Training

In addition, the client would favour awareness training to be carried out such as weekly Toolbox Talks on relevant topics e.g. manual lifting, wearing PPE, safe use of portable electric tools etc.

PE9.3.3 Competency and CV's

Where applicable, valid copies of certificates of competency of appointed personnel to be provided and kept in the HSF. Other training requirements such as those identified through the HRA process, to be completed and proof of that training also kept in the HSF. Where competency is achieved through experience, a brief CV will be required.

PE9.3.4 Specific OH&S Training

Valid certificates of training from registered service providers preferably accredited by the appropriate SETA are required for First Aiders, H&S reps, Fire Marshals (CR21 Fire Equipment Inspectors) etc.

PE9.3.5 Medical Fitness

All employees doing construction work on site must have a valid medical certificate of fitness specific to construction work to be performed and this must be issued by an occupational health practitioner in the form of Annexure 3.

PE9.4Hazards and Potentially Hazardous Situations [OHSA 13]

The principal contractor is responsible to ensure that all contractors and any visitors are warned of any hazardous or potentially hazardous situations, which may affect them on site and shall put any additional measures in place to assist in mitigating the risk of these hazards.

PE9.5Health and Safety Reps [OHSA 17 and 18]

The principal contractor shall be responsible to ensure compliance to this section of the OHSA as required and to ensure similar compliance of all contractors.

If a rep is not required, the appointed Safety Officer will be responsible for these functions

PE9.6Health and Safety Committee [OHSA 19 and 20]

The principal contractor shall be responsible to ensure compliance to this section of the OHSA as required. If a committee is not convened, health and safety matters will need to be tabled and discussed at site meetings.

PE9.7General Documents / Record Keeping

The principal contractor shall ensure that all Health and Safety documents and records, required by OHSA and Regulations are kept on site for reference purposes and auditing.

PE9.7.1 Inspections

The principal contractor shall keep all records of inspections undertaken during the contract. An assessment will need to be made of what inspections are required and their frequency. The principal contractor is also responsible to ensure compliance to this requirement by all contractors

PE9.7.2 Audits [CR 5 (0) and 7 (1c)(vii)]

The client's agent shall carry out regular audits on the principal contractor at least once per month. Similarly, principal contractors shall be responsible for carrying out regular audits on their contractors at least once per month. The results shall be tabled for action and discussed at the Health and Safety Committee meetings or the site meetings, as appropriate.

PE9.8 Incident management and emergency plans

The principal contractor shall create an Emergency Plan for the construction site. The plan shall be clearly laid out for all types of emergencies including responsibilities, evacuation routes, siren, emergency no.'s etc. The plan shall be fully explained to all personnel during the induction training. All contractors will become completely familiar with the requirements of the plan and will participate in any evacuation drills that may take place.

PE9.8.1 First Aid [GSR 3]

The principal contractor shall be responsible to ensure compliance to this regulation as required. In particular, a first aid box with the minimum stock as specified in the regulation will be located at the site office and there will be signage to indicate the location of the box. Attention is drawn to GSR 3(4) for the requirement of trained first aiders. It is also suggested that a trained first aider be made responsible for the box in terms of the following:

- Security – the box should not be left open, but it must be accessible in case of emergency (spare key availability)
- Injuries - a record of first aid box injuries treated and the stock issued
- Stock – a regular inspection to maintain stock levels and check expiry dates

In addition, the first aid requirements should be noted for high-risk substances or hazardous chemical substances and if these are to be used, then it should be addressed in the HIRA and the need for eye wash facilities assessed.

PE9.8.2 Incidents and Injuries – Investigation and Reporting

The Principal Contractor will ensure there is a management system to report and investigate all incidents. All incidents including ALL near misses, first aid box treatment, and all other serious incidents involving any form of disabling injury or fatality are to be reported to the Client and the Clients H&S Agent telephonically immediately. This shall be confirmed in writing as soon as possible after the incident. Failure to comply with these provisions will be considered a serious offence. "Recording and Investigation of Near Misses".

Incidents

The principal contractor shall provide evidence by means of a procedure or chart that he is fully aware of the "hierarchy" of incidents that can occur e.g. unsafe situations, near misses, first aid box injuries, medical cases, disabling injuries etc. He shall keep an incident register of all such incidents, investigate and implement corrective action where required. The client also reserves the right to request incident statistics from the principal contractor such as DI's, DIFR and DISR and it is advised that these are maintained.

Injuries

First aid box injuries have been addressed under 8.8.1 above. More serious injuries requiring transport of the injured person to the nearest hospital or doctor, or the calling of ambulance and paramedic personnel will be the responsibility of the principal contractor's appointed personnel such as the Construction Supervisor, First Aider and Safety Officer. It is advised that all required emergency numbers be on hand and prominently displayed.

As all contractors are registered and in Good Standing with the Compensation Commissioner, it will be the responsibility of the contractor whose employee has been injured, to make the necessary report and claims to the Commissioner.

PE9.8.3 Accident and Incident Reporting and Investigation [OHSA 24, GAR 8, 9 (1) & (2)]

Should an incident or accident investigation need to be conducted, a competent person shall be appointed to conduct the said investigation. The procedure to be followed will be in accordance with Annexure 1 of GAR 9 – "Recording and Investigation of incidents".

Particular attention is also drawn to OHSA 24, the reporting of certain incidents to an inspector of the department of labour.

The principal contractor shall ensure that the investigations are kept for record purposes, and he shall ensure that the outcome of the investigation is communicated to all affected parties as required i.e. the Client, Clients H&S Agent and contractors.

The Client reserves the right to participate in all investigations into accidents or incidents and to conduct their own investigation if required.

PE9.9 Contractors and Suppliers [OHSA 37(2)]

The client shall enter into an "Agreement with Mandatory" in terms of Section 37(2) of the Occupational Health and Safety Act, 85 of 1993, with all appointed principal contractors. Likewise, all principal contractors shall enter into a similar agreement with all contractors, sub-contracted to them for any period of the contract. Please note that if contractors hire any construction vehicles or mobile plant, the companies from which the equipment is hired must provide any maintenance and test certification as required. In addition, if operators are hired with the equipment, proof of competence and medical certification must be provided.

The principal contractor shall ensure that all contractors are issued with this safety specification where reasonable. The principal contractor shall assist and ensure that contractors engaged comply with all of these requirements and adhere to the requirements set out in the OHSA. Contractors will be stopped from working in the event of unsafe conditions and activities being observed.

All contractors shall be subject to the requirements specified in the HSP and will be issued with a copy of the plan. If the contractor is not able to comply with the requirements set out in the plan, he shall not be appointed as contractor.

PE9.10 Personal Protective Equipment, Intoxication, Signage and Access Control

PE9.10.1 Personal Protective Equipment (PPE) [GSR 2]

The principal contractor shall through the Risk Assessment process identify the specific PPE needs per activity. Contractors, as employers, will be responsible for the issue of the required PPE. Should PPE be lost or stolen, then the employee will be issued with new PPE. Should PPE be worn out or damaged, the user shall return the worn or damaged PPE and will be issued with a replacement. Training in the use of this shall be provided. Visitors shall be informed of PPE requirements prior to their visit so that they may enter the site.

PE9.10.2 Intoxication [GSR 2A]

The principal contractor shall ensure that no persons may enter or remain at the construction site if under or apparently under the influence of intoxicating liquor or drugs.

PE9.10.3 Display of signs [GSR 2B]

The principal contractor shall make use of signage to assist in enforcing compliance to any requirement specified in this document or as required by law. Standard symbolic signs are acceptable for conveying these requirements where applicable. Approved signs as per SABS standard approved colours must be used.

PE9.10.4Access control [GSR 2C]

The principal contractor shall be responsible to ensure control of access to all persons entering the construction site. The reasons for this are as follows:

- The principal contractor is the 'employer' on the site and is responsible for section 8 of OHSA for employees and contractors and section 9 for any other person on site such as visitors and inspectors
- All persons entering the site must undergo induction training to inform them of the hazards present on the site. This includes contractors, visitors, inspectors etc.
- The construction supervisor will be aware of who is on site and their function
- The construction supervisor will be able to control tasks that may impact on other work being carried out on the site by a permit to work system
- The number of people and their purpose on the site must be known in case of emergency and evacuation
- Security reasons

The principal contractor shall post notices at the site informing all those entering the site of these requirements.

PE9.10.5Pressure Equipment Regulations, 2009 (Gas Bottles) [PER 2009]

If gas bottle sets (Oxy-Acetylene for heating, cutting, welding) are used, these regulations, as required, shall be adhered to. Regular inspection of the sets shall be carried out. In particular:

- Only trained personnel shall operate such equipment.
- The Construction Supervisor shall ensure operation of the equipment is in accordance with the HIRA requirements and Safe Working Procedure (SWP) and/ or method statement.
- All users shall undergo regular awareness training (toolbox talk) to ensure compliance.
- The Construction Supervisor shall ensure the required PPE is provided and properly used.

PE9.10.6Portable Electrical Tools [EMR 9]

This regulation shall be complied with as a minimum requirement. Regular inspections of all Portable Electrical Tools such as drills, angle grinders etc., and shall be carried out. In particular:

- Only trained personnel shall operate such equipment.
- The Construction Supervisor shall ensure operation of the equipment is in accordance with the HRA requirements and Safe Working Procedure (SWP).
- All users shall undergo regular awareness training (toolbox talk) to ensure compliance.
- The Construction Supervisor shall ensure the required PPE is provided and properly used.

PE9.11 Permit to work (including hot work)

The principal contractor shall ensure that:

- All work being carried out on the site has been approved through the necessary project control system.
- Permits required from third parties such as town councils for utility and sewage services are in place.
- A permit system is operational so that work consisting of many tasks related to the construction on site, can be carried out without endangering the health and safety of personnel on site, neighbours and the public surrounding the site and/or causing damage to property.
- In particular, attention is drawn to GSR 9, which details the requirements for welding, flame cutting, soldering and similar operations (hot work) especially since there is dry grass which can catch fire resulting to veld fires.

PE9.12. Work in confined spaces [GSR 5]

The principal contractor shall ensure that no work is carried out in a confined space unless it is safe to do so. All the requirements of this regulation shall be met. Attention is drawn to the fact that further precautions are required if hot work is to be carried out in a confined space a per GSR 5(5) and GSR 9(2).

In addition, CR 13(2j) specifies that excavations are regarded as confined spaces and these precautions need to be applied.

PE9.13 Environmental Rules

The Contractor shall give effect to and maintain all safeguards and standards and take such measures as may be necessary for the protection of the environment. Prevention of any type of pollution must be taken into consideration when performing all construction activities on site.

PE9.13.1Clearing

The Contractor shall comply with the following conditions and requirements for clearing:

- Follow the Occupational Health and Safety Act, the Environmental Regulations for workplaces and Project EMP.
- Areas to be cleared will have boundaries clearly marked by tape, pegs or other means and will conform to limits on design drawings.
- Clearing will not commence until drainage control works are in place.
- Cleared vegetation should be windrowed along the contour to assist with erosion control.
- Any area which is not to be disturbed under requirements of the Cultural Heritage Management Plan will be clearly identified.

- Vegetation clearance will be restricted to that necessary for the works.
- The Engineer is to be notified immediately if contaminated soil is discovered.
- Traffic shall be confined to maintained tracks and roads.
- Particular care shall be taken to minimise disturbance to the bed and banks of watercourses.

PE9.13.2 Noise and Vibration

The Contractor shall ensure that the exposure of persons to noise is prevented by all means and where it is not possible to prevent it, to adequately control the noise. The noise-induced hearing loss regulations must be complied with.

Each of its mobile and fixed plant and that of its subcontractors are fitted with appropriate noise suppression equipment to ensure that noise levels from such plant are contained within the relevant limits prescribed by relevant industrial safety and environmental legislation, regulations and site standards. If there is a noise problem with electric power generating equipment, compressors, or other facilities under the control of the Contractor, additional noise suppression shall be erected by the Contractor at the Contractor's cost around the offending unit(s).

Any deviation from the above listed practices is to be rectified at the Contractor’s cost.

PE9.13.3 Transport, Storage and Handling of Hazardous Substances and Dangerous Goods

The Contractor shall comply with the following conditions and requirements for storing and handling hazardous and dangerous goods:

- Comply with Hazardous Chemical Substance Regulations.
- Provide a list of hazardous substances and corresponding MSDS prior to bringing substances on Site.
- Substance register to be held at each storage facility.
- Corrosive materials to be stored and handled in accordance with HCS Regulations 14.
- Fuel, oils and substances in containers of 210 litres or more shall be stored in a bunded area with capacity of at least 110% of the total quantity of HCS.
- Fuel, oils and substances in less than 200 litre drums shall be stored as above or in a fenced and roofed compound.
- All fuel, oils and substances must be clearly labelled.
- Transfer of bulk fuel and handling of hazardous substances shall be conducted only by appropriately trained personnel.
- Spill clean-up kits including absorbent materials shall be kept at each storage facility.

PE9.13.4 Dust Prevention

The Contractor shall comply with the following conditions and requirements for air quality and dust:

- Dust generated by construction activities will be suppressed by water spraying, to levels that are safe for Site personnel.
- Speed limits on unsealed roads will be limited to a maximum speed consistent with the minimisation of dust generation.
- Earthworks Supervisors must pay particular attention to the management of topsoil stripping such that dust does not become a safety hazard or severe nuisance.
- All dust complaints will be investigated promptly, and appropriate action initiated to reduce nuisance.

PE9.13.5 Waste Management

- The Contractor shall provide suitable rubbish receptacles at the Site and shall ensure that all litter is collected in them and properly disposed of off Site in accordance with the requirements of the relevant statutory requirements.
- The Contractor shall ensure proper collection and off-site disposal of all industrial wastes in accordance with relevant statutory requirements.
- The Contractor shall apply the principles of Waste Minimisation by reducing the amount of waste generated on Site by their operations and activities as much as possible. The Contractor shall provide for recycling of glass, metals, plastics and paper.

PE9.14 Monitoring, Audit and Review

The Client's Agent shall have the right to conduct audits / inspections of the Contractor's operations, equipment and procedures at any time, and the Contractor shall fully co-operate with the Client's Agent during such audits / inspections.

The Client's Agent rights under this clause shall not relieve the Contractor of its obligations to conduct audits and reviews of its own safety and health performance.

Where such Client's Agent audits reveal deficiencies in the Contractor's procedures, equipment, training, drills, etc., the Contractor shall rectify such deficiencies as soon as practicable and provide to the Client's Agent a status report on all outstanding corrective actions. Where such deficiencies include an unsafe practice or a breach of the Statutory or the Contract's requirements, the Client's Agent may in accordance with the General Conditions of Contract suspend the work associated with the unsafe practice or breach until the deficiency is rectified.

PE10 Application of the Construction Regulations, 2014

[Please note: this is the complete list. Item 10.1 is compulsory, and the rest are applicable if relevant to the work being carried out]

PE10.1 Hazard Identification, Risk Assessment and Risk Control (HIRA) [CR 9]

The contractor shall prior to the commencement of any construction work perform a HIRA exercise, which will form part of the HSP and file for the project.

A copy of the HIRA shall be made available for viewing to the client's OHS agent and shall be kept in the Health and Safety File.

NB: The contractor shall ensure that the outcome of all HIRA exercises will be conveyed to all relevant employees with respect to the hazards and the related control measures before any work commences.

Below is a list of activities, which may be considered for HIRA if the activity is to be carried out on site. The list is not exhaustive but gives examples of activities for a construction site:

- Traffic Management– restrictions etc.
- Site security and access
- Existing services, overhead and underground
- Ground conditions
- Excavations
- Activities that affect adjacent sites
- Excavations in particular those adjacent to roads or sidewalks
- Stacking, storage of equipment and materials, and good housekeeping
- Use of hand tools
- Use and storage of flammable and hazardous chemicals such as petrol, diesel, etc.
- Waste management including removal of hazardous waste
- Environmental restraints such as effluents, boundary noise and dust
- Temporary site accommodation
- General hazards to site personnel such as noise and dust.

The control of several of these risks may be specified in the OHSA or the CR but this does not mean that the HIRA exercise does not have to be carried out.

PE10.2 Fall Protection [CR 10]

Regulation 10(1)(a) of this regulation states that a contractor shall designate a competent person, to be responsible for the preparation of a fall protection plan. The fall protection should include the prevention of person falling into trenches due to ground preparations.

PE10.3 Structures [CR 11]

The appointed contractor shall meet the requirements of this regulation. Attention is drawn to CR 11(2)(a) which requires the designer to inspect the structure at appropriate times when mandated by the Client and the record of these inspections to be available on site.

PE10.4 Excavations [CR13]

Section 1 of this regulation states that this work must be carried out under the supervision of a competent person, who has been appointed in writing. All the requirements of CR 13 shall be met. For inspection of excavations, attention is drawn to sub regulation 2(h), the records of which must be available on site.

All the requirements as far as GMR 18 is concerned, compliance to these requirements will be the responsibility of contractors using any lifting equipment and lifting tackle.

The principal contractor must comply with the requirement of the Construction Regulations 22 and the requirements of the Driven Machinery Regulations 1988.

PE10.5 Construction vehicles and mobile plant [CR 23]

It will be the responsibility of each contractor on site to ensure compliance of their construction vehicles and mobile plant to these regulations.

This includes vehicles to be used for transporting personnel to and from site, which will be subject to relevant requirements such as licensing and roadworthiness checks. In addition the following will apply:

- Safe transport for personnel working on the project to and from the workplace, which shall include proper seating, side restraints and cover.
- Road safety principles shall be adhered to on and off site.

If a mobile crane or other mobile plant is hired, only approved hire companies shall be contracted to provide such equipment. The Construction Supervisor shall ensure compliance of the provider to these regulations. In particular attention is drawn to the competence and fitness of the operator [section 1(d)] and the inspection of the equipment [section 1(j)]

PE10.6 Use and storage of flammable liquids [CR 25], and hazardous chemical substances [HCSR]

All the requirements of CR 25 shall be met

In terms of HCSR, contractors shall ensure that all hazardous chemicals brought to site have a Material Safety Data Sheet (MSDS) and the users are made aware of the important sections of the MSDS such as:

- Hazards
- First aid measures
- Firefighting measures
- Accidental release measures
- Handling and storage
- Exposure control especially PPE
- Disposal

First Aiders shall be made aware of the MSDS and how to treat HCS incidents appropriately. Copies of MSDS's will be available on site and in the HSF.

PE10.7 Water Environments [CR 26]

The requirements of this regulation shall be met. i.e

- A contractor must ensure that where construction work is done over or in close proximity to water, provision is made for –
  - ➢ Preventing persons from falling into water
  - ➢ The rescuing of persons in danger of drowning.
- A contractor must ensure that where a person is exposed to risk of drowning by falling into the water the person is provided with and wears a lifejacket

PE10.8 Housekeeping [CR 27] including [ERW (6)]

All contractors shall ensure that housekeeping standards as per these regulations shall be maintained at all times.

PE10.9 Stacking of Materials [CR 26] including [GSR (8)]

All contractors shall ensure that materials are only stored in defined and allocated storage areas and that materials being stored are stacked in accordance with sound stacking principles as per these regulations.

PE10.10Fire precautions [CR 29]

All contractors on site will comply fully with the requirements of this regulation. In particular, the principal contractor will be responsible for the evacuation plan (section (l)) the details of which will be imparted to contractors, visitors etc. through the site induction.

PE10.11Construction welfare facilities [CR 30]

The principal contractor shall be responsible for implementing this regulation and shall ensure that adequate facilities are provided for the personnel on site in terms of the following:

- Change room facilities
- Adequate toilets.
- Hand wash facility.
- Potable water.

No food preparation shall be conducted on site. Eating and drinking will only be permitted in the designated eating areas, which must be provided with adequate seating.

Waste bins shall be strategically placed and cleared regularly.

PE11 Site Specific and Design Risks

[Please note this is not a complete or exhaustive list. The principal contractor is expected to assess all risks to which his employees may be exposed during the construction process, as well as the hazards identified and listed below.]

PE11.1 Hazard Identification and Risk Assessment Methodology

PE11.1.1. Baseline Risk Assessment

A Baseline Hazard Identification and Risk Assessment must be carried out during the preliminary stages of the construction/demolition project for the purposes of attempting to reduce the possibility of accidents or ill health occurring.

Taking into account the constraints of time and resources, every effort must be made to identify the hazards and recommend possible solutions. It is not reasonably practicable to expect the baseline risk assessment to identify all hazards, which is why task risk assessments are carried out on site.

PE11.1.2. Task Risk Assessment

Once on site, every contractor shall perform task risk assessments, using the baseline risk assessment as a guide.

The Risk Assessment should be reviewed once on site and thereafter after any incident, change in design or every one-year period, whichever occurs first. Additional hazards highlighted or a change in the risk factor should have a separate risk assessment carried out and filed.

The Risk Assessment is based on the combination of the CONSEQUENCE and PROBABILITY associated with each hazard.

PE12 Scope of Works

This specification covers the health and safety requirements to be fulfilled by the Contractor to ensure a continued safe and healthy environment for all workers, employees and subcontractors under his control, and for all other persons entering the site of works.

This specification shall be read with the Occupational Health and Safety Act No 85 of 1993, and the corresponding Construction Regulations 2014, and all other safety codes and specifications referred to in the said Construction Regulations.

In terms of the OHS Act Agreement in **Annexure 3**, the status of the Contractor as mandatory to the Employer (Client) is that of an employer in his own right, responsible to comply with all provisions of OHS Act 1993 and the Construction Regulations 2014.

This Health and Safety Specification and the Contractor's own Safety Plan as well as the Construction Regulations 2014, shall be kept on site and made available for inspection by all employees, inspectors, Client Safety Practitioner and any other persons entering the site of works.

ANNEXURE A – Notification of Construction

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993
(ACT NO 85 OF 1993)
REGULATION 4 OF THE CONSTRUCTION REGULATIONS, 2014
NOTIFICATION OF CONSTRUCTION WORK

1.(a) Name and postal address of Principal Contractor:

.....

(b) Name and tel. no of Principal Contractor's contact person:

.....

2. Principal Contractor's compensation registration number: .....

3.(a) Name and postal address of client:

.....

(b) Name and tel. no of client's contact person or agent:

.....

4.(a) Name and postal address of designer(s) for the project:

.....

(b) Name and tel. no of designer(s) contact person:

.....

5. Name and telephone number of Principal Contractor's construction supervisor on site appointed in terms of regulation 8. (1) .....

6. Name/s of principal contractor's sub-ordinate supervisors on site appointed in terms of regulation 8. (2).

.....

7. Exact physical address of the construction site or site office:

.....

8. Nature of the construction work

.....

.....

.....

9. Expected commencement date: .....

10. Expected completion date: .....

11. Estimated maximum number of persons on the construction site: Total: ..... Male: ..... Female: .....

12. Planned number of contractors on the construction site accountable to principal contractor: .....

13. Name(s) of contractors already chosen.

.....

.....

.....

....

Principal Contractor Date

....

Client's Agent (where applicable) Date

....

Client Date

- THIS DOCUMENT IS TO BE FORWARDED TO THE OFFICE OF THE DEPARTMENT OF LABOUR **PRIOR TO COMMENCEMENT** OF WORK ON SITE.

- **ALL PRINCIPAL CONTRACTORS** THAT QUALIFY TO NOTIFY MUST DO SO EVEN IF ANOTHER PRINCIPAL CONTRACTOR ON THE SAME SITE HAD DONE SO PRIOR TO THE COMMENCEMENT OF WORK.

ANNEXURE B – CEO Appointment

CEO ASSIGNMENT IN TERMS OF SECTION 16(2) OF THE OHSA (ACT 85 of 1993)

Section 16 of the Act states:

(1) Every chief executive officer shall, as far as is reasonably practicable, ensure that the duties of his employer as contemplated in this Act; are properly discharged.

(2) Without derogating from his responsibility or liability in terms of sub-section (1), a chief executive officer may assign any duty contemplated in the said sub-section, to any person under his control, which person shall act subject to the control and directions of the chief executive officer.

(3) The provisions of sub-section (1) shall not, subject to the provisions of section 37, relieve an employer of any responsibility of liability under this Act.

(4) For the purpose of sub-section (1) the head of department of any department of State shall be deemed to be the chief executive of that department.

I, (full name of CEO) .....do hereby assign my duties in

respect of the overall management and control of to (full name of Appointee)

in his/her capacity as to ensure that the duties of the employer are carried out as contemplated in the Act and the Regulations as amended for (division/area/region/premises/project(s)).

SIGNATURE: ..... **DATE:** .....

Designation: Chief Executive Officer

Kindly confirm your acceptance of this appointment by completing the following:

ACCEPTANCE OF ASSIGNATION

I,..... hereby accept this assignation and confirm that I am conversant with the requirements of the OHS Act and regulations as amended and agree to carry out the duties as set out for the employer.

NOTE: Your Attention is Drawn to regulation General Administrative Regulation 5 and Sections 8, 9, 13, 17, 18, 19, 20 and 37 of the Occupational Health and Safety Act No. 85 of 1993.

SIGNATURE: ..... **DATE:**.....

Designation :.....

ANNEXURE C – Appointment of H&S Representatives

APPOINTMENT OF HEALTH AND SAFETY REPRESENTATIVE IN TERMS OF SECTION 17 OF THE OHSA

(ACT 85 of 1993)

(APPOINTEE'S NAME*)* ....

I, (Appointer's full name) ..... being an employee of (name of Contractor's organization) ..... and, having been appointed as (area of responsibility e.g. Responsible Person for the construction of X on site Y)

....., hereby appoint you (Appointee's full name)

..... in terms of

Section 17 of the OHSA as the Health and Safety Representative for (area of responsibility)

.....

In terms of this appointment your functions are as follows:

- To represent your employee electorate's interests in terms of occupational health and safety.
- To carry out health and safety inspections of your workplace as designated above prior to each appropriate health and safety committee meeting.
- To serve on the appropriate health and safety committee.
- To bring to the attention of your supervisor any deviations from the safe work procedures any other matters regarding health and safety that come to your attention at any time.

The dates and times of the health and safety committee meetings will be determined by the committee(s). You should attend all meetings of the health and safety committee on which you serve.

You will be required to undergo Health and Safety Representative training in order to ensure that you can complete your tasks successfully.

Your appointment is valid from (start date) ..... to (end date) .....

Appointer's Signature..... Date.....

Kindly confirm your acceptance of this appointment by completing the following:

ACCEPTANCE

I, (Appointee's full name) ..... understand the implications of the appointment as detailed above and confirm my acceptance.

Appointee's Signature..... **Date**.....

ANEXURE D – Recording of Incidents

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 (ACT NO 85 OF 1993) REGULATION 9 OF THE GENERAL ADMINISTRATIVE REGULATIONS RECORDING AND INVESTIGATION OF INCIDENTS

A. RECORDING OF INCIDENT

1. Name of employer .....

2. Name of affected person.....

3. Identity number of affected person.....

4. Date of incident ..... 5. Time of incident..... 6.

Part of body affected					
	Head or Neck	Eye	Trunk	Finger	Hand
	Arm	Foot	Leg	Internal	Multiple

7. Effect on person					
	Sprains or strains	Contusion or wounds	Fractures	Burns	Amputation
	Electric shock	Asphyxiation	Unconsciousness	Poisoning	Occupational Disease

8. Expected period of disablement						
	0-13 days	2-4 weeks	4-16 weeks	16-52 weeks	52 weeks or permanent disablement	Killed

9. Description of occupational disease.....

10. Machine/process involved/type of work performed/exposure** .....

11. Was the incident reported to the Compensation Commissioner and Provincial Director?

Yes	No

12. `Was the incident reported to the police? *

Yes	No

13. SAPS office and reference .....

* to be completed in case of a fatal incident.

** in case of a hazardous chemical substance, indicate substance exposed to:

B. INVESTIGATION OF THE ABOVE INCIDENT BY A PERSON DESIGNATED THERETO

1. Name of investigator .....
2. Date of investigation .....
3. Designation of Investigator .....
4. Short description of incident

   .....

   .....

   .....
5. Suspected cause of incident

   .....

   .....

   .....
6. Recommended steps to prevent a recurrence

   .....

   .....

   .....

Signature of Investigator: ..... *Date: .....*

C. ACTION TAKEN BY EMPLOYER TO PREVENT THE RECURRENCE OF A SIMILAR INCIDENT

.....

.....

.....

Signature of Employer: ..... Date: .....

D. REMARKS BY HEALTH AND SAFETY COMMITTEE

Remarks:

.....

.....

.....

Signature of Chairperson of Health & Safety Committee: ..... *Date: .....*

ANNEXURE E – Index of Project Health & Safety File

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 (ACT NO 85 OF 1993) REGULATION 5(1)(b) OF THE CONSTRUCTION REGULATIONS, 2014 PROJECT HEALTH & SAFETY FILE

1. LEGAL APPOINTMNENTS

- Updated Legal Appointments Register.
- Updated OH&S Organogram.
- Legal Appointments.
- Client Legal Appointment
- 37(2) Agreement with Client

2. COMPANY DOCUMENTATION

- Company Health & Safety Policy and other Policies
- Current Company Letter of Good Standing (WCA)
- Company & Site OH&S Rules
- Client Health & Safety Specifications
- Health & Safety Plan
- Notification of Construction Work (with proof of transmittal)
- Employee Medical Examination Certificates
- Certificates of Competence (CoC)

3. RISK ASSESSMENTS & SAFE WORK PROCEDURES

- Risk Assessments & SOP's Register
- Risk Assessments & SOP's
- List of Site Mandatory PPE.
- Method Statements

4. TRAINING

- Induction Training Manual.
- Induction Training Register
- Toolbox Talks
- First Aiders
- Health & Safety Representatives
- Scaffold Erectors & Inspectors
- Risk Assessor(s)
- Fire Teams
- Operators Of Machinery
- Etc…

5. SUB-CONTRACTOR MANAGEMENT

- Approved Sub-Contractor List.
- Sub-Contractor Legal Appointment
- Sub-contractor Letter of Good Standing
- Sub-Contractor Health & Safety Plan
- Mandatory Agreements with Principal Contractor
- Sub-Contractor Audit Reports
- Sub-Contractor Medicals
- Sub-Contractor Organogram & Legal Appointments

6. INCIDENT MANAGEMENT

- Incident Management/Reporting Procedure
- Emergency Procedure
- Simulation Drills
- Monthly Incident Statistics/Reports
- Incident/Accident Investigation Reports

7. OH&S AUDITS & INSPECTIONS

- Client's Audit Reports.
- Principal Contractor's Audit Reports
- Principal Contractor's Health & Safety Inspections.
- Health & Safety Representatives' Reports (Signed by Committee Chairperson).

8. OH&S MEETINGS

- Project OH&S Coordination Meetings (where applicable)
- Principal Contractor's Health & Safety Committee Members List
- Principal Contractor's Health & Safety Committee Meetings minutes (with agenda & attendance registers)

9. INSPECTION REGISTERS (As per site requirements)

ANNEXURE F Legal Appointment of Register

Name	Designation	Appointment name	Appointment clause	Date appointed	On site	Off-site
	Site manager	Manager	16(2)	11-Jul-10	X	
	General Foreman	Supervisor of Construction work	CR 6(1)	12-Jul-10	X	
	truck driver	Construction vehicle operator	CR21	11-Jul-10	X	
	Foreman	Assistant to Sup. Of construction work	CR 6(2)	11-Jul-10		X
	Mechanic	Safety Representative	OHSAct 17(1)	12-Jul-10	X	
	Foreman	Excavation Supervisor	CR 11(1)	13-Jul-10		X

3: SCOPE OF WORKS

C3.8.7 PARTICULAR SPECIFICATION: PZ - EMPLOYER'S ENVIRONMENTAL MANAGEMENT SPECIFICATION FOR ENVIRONMENTAL MANAGEMENT OF CONSTRUCTION PROJECTS

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C3.8.7 PARTICULAR SPECIFICATION: PZ - EMPLOYER'S ENVIRONMENTAL MANAGEMENT SPECIFICATION FOR ENVIRONMENTAL MANAGEMENT OF CONSTRUCTION PROJECTS

PZ1 INTRODUCTION

PZ1.1 SCOPE

This specification is additional to the South African Bureau of Standards Standardised Specification for Civil Engineering Contracts and must be read in conjunction with the said specification.

This specification covers the principles, responsibilities and requirements generally applicable to implement effective environmental management during the execution of any construction contract. is so doing this Specification represents minimum standards of conduct applicable to the contract with respect to environmental management. In addition, the specification references specific requirements of the Environmental Authorisation and Environmental Management Programme (EMPr) for Phase 1 of the project.

For more detailed requirements the Contractor is directed to the EMPr which forms part of this contract. The requirements of the EMPr rule and supersede those of this Specification.

The aim of this specification is to ensure that construction activities are conducted in an environmentally and socially responsible manner and that the requirements of the Environmental Authorisation and Environmental Management Programme are kept in mind at all times.

PZ1.2 INTERPRETATIONS

This specification contains clauses that are generally applicable to the implementation of effective environmental management on construction contracts. Interpretations of, and variations to, this specification are set out in the project specification.

PZ1.2.1 Supporting specifications:

Reference is made to the SABS 1200 standards which are to be read in conjunction with this specification. All aspects of these SABS requirements which are relevant to environmental management during construction contracts will apply.

PZ1.2.2 Principles

The following principles should be considered at all times during construction phase activities:

- The Environment is considered to be composed of both biophysical and social components.
- Construction is a disruptive activity, and all due consideration must be given to the environment, particularly the social environment, during the execution of a project to minimise the impact on affected parties.

- Minimisation of areas disturbed by construction activities will minimise many of the construction related environmental impacts of the project and reduce rehabilitation requirements and costs.
- As minimum requirements, all relevant standards relating to international, national, provincial and local legislation, as applicable, shall be adhered to. This includes requirements relating to waste emissions (e.g. hazardous, airborne, liquid and solid), waste disposal practices, noise regulations, road traffic ordinance etc.
- All effort should be made to minimise, reclaim or recycle 'waste' material. The disposal of waste material is subject to strict conditions and sanctions apply to unauthorised disposal.

PZ1.3 DEFINITIONS

For the purpose of this specification, the definitions given in SABS 1200 shall apply.

Additional definitions which shall apply to this specification are as follows:

Environmental Control Officer: Either an Employer's staff member or an Environmental Consultant assigned to the project on a part or full-time basis. The Environmental Control Officer will be part of the Project staff and will advise the Employer's Agent on all environmental matters relating to the works, in terms of this specification and the project specification, if applicable.

Environmental Officer: Either an Employer's employee (e.g. Quality Assurance Inspector) or Consultant designated to monitor the implementation and compliance with the environmental specifications and environmental management plan on a daily basis.

Cleared surface: "surface vegetation" as referred to in SABS 1200 C 2.3 will be deemed to be any woody or herbaceous vegetation but exclude grasses, sedges, rushes and reeds. Clearing and grubbing shall for the purpose of this specification mean the removal of all woody and herbaceous vegetation including stumps, but excluding grass and groundcover vegetation.

Employer's Agent: As defined in GCC2015

Interested and Affected Parties (IAP): All persons who may be affected by the project either directly or indirectly, or who have an interest or stake in the area to be affected by the project. IAPs include landowners, tribal or local authorities, public interest groups etc.

Liquid Waste Stream: Any reagent solutions, fuels, oils, greases, contaminated run-off, sewerage and wash water, etc.

Open Trench: Open trench will, for the purpose of this specification, be deemed to include: clearing and grubbing; stripping of topsoil; trenching; placing of bedding; pipe-laying; placing of selected fill; backfilling to ground level; removing excess material; construction of cross berms to channel water (if required); and replacement of topsoil to final finished level (refer to Figure 1: Appendix A).

Progressive Reinstatement: Reinstatement of disturbed areas to topsoil profile on an ongoing basis, immediately after selected construction activities (e.g. backfilling of a trench) are completed. This allows for passive rehabilitation (i.e. natural recolonisation by vegetation) to commence. See also 'Open Trench' and 'Rehabilitation'.

Rehabilitation: Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (where possible) which it was before disruption. Rehabilitation for the purposes of this specification is aimed at post-reinstatement revegetation of a disturbed area and the ensurance of a stable land surface. Revegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired way, i.e. promote rapid vegetation establishment.

Riparian vegetation: Vegetation occurring on the banks of a river or stream (i.e. vegetation fringing a water body). In this specification, riparian vegetation in terms of removal, storage and replacement (see PZ3 17.1 and PZ3 17.2), is only applied to sedge, grass, groundcover, reed, bulrush, or herbaceous component of riparian vegetation and excludes the woody component.

Sedges: Grass-like plants growing in wetland/ marshy areas or adjacent to water.

Subsoil: Subsoil is the soil horizons between the topsoil horizon and the underlying parent rock. Subsoil often has more clay-like material than the topsoil. Subsoil is of less value to plants, in terms of nutrient (food) and oxygen supply, than topsoil. When subsoil is exposed, it tends to erode fairly easily.

Timeous: At least 5 working days prior to an activity.

Topsoil: This is defined as the A horizon of the soil profile. Topsoil is the upper layer of soil from which plants obtain their nutrients for growth. It is often darker in colour, due to the organic (humic) fraction. Topsoil is deemed for the purposes of this specification as the layer of soil from the surface to the specified depth required for excavation (see PZ3 5.3, relevant SABS 1200 clause and project specification). Where topsoil is referred to, it is deemed to be both the soil and grass / ground cover fraction. (see 'Cleared Surface')

Veld: This is defined for the purpose of this specification as unimproved natural vegetation areas (e.g. grasslands).

Water body: Any open body of water including streams, dams, rivers, lakes, and the sea.

Wetland: A seasonally, temporally, or permanently wet area which also may exhibit a specific vegetation community. It is often marshy in character.

Wetland Vegetation: Vegetation which is indicative of a wetland environment - for example, sedges, rushes, reeds, hydrophilic grasses and groundcovers, but for the purposes of this specification excludes woody species.

Xeriscaping: Landscaping with vegetation which has a low water usage. The objective is to conserve as much water as possible, whilst still beautifying an area (i.e. conservation and aesthetics). Concept embraces utilising indigenous as opposed to exotic plants.

PZ1.4 ABBREVIATIONS

DWS : Department of Water & Sanitation (previously Dept of Water Affairs)
ECO : Environmental Control Officer
EMP : Environmental Management Plan (in this contract the EMPr)
EMPR : Environmental Management Programme Report (in this contract the EMPr)
EO : Environmental Officer
IAPs : Interested and Affected Parties
IEM : Integrated Environmental Management
MSDS : Material Safety Data Sheet

PZ1.5 DRAWINGS

Drawings referred to in this specification are included in Volume 2: Drawings.

PZ1.6 FORMS

Forms referred to in this specification are included in Part T2 or attached to this environmental specification.

PZ1.7 CONDITIONS OF CONTRACT

PZ1.7.1 Duties and Powers of the Employer's ISD Representative

The Employer's ISD Officer:

- arranges information meetings for or consults with IAPs about the impending construction activities.

- may on the recommendation of the Employer's Agent and /or Environmental Officer order the Contractor to suspend any or all works on site if the Contractor or his Subcontractor/ supplier fails to comply with the said specifications.
- maintains a register of complaints and queries by members of the public at the site office as per attached pro-forma. This register is forwarded to the Environmental Control Officer on a monthly basis.

PZ1.7.2 Duties and Powers of the Employer's Agent

The Employer's Agent is responsible for:

- enforcing the environmental specification on site.
- monitoring compliance with the requirements of the specification.
- assessing the Contractor's environmental performance in consultation with the Environmental Officer from which a brief monthly statement of environmental performance is drawn up for record purposes.
- documenting, in conjunction with the Contractor, the state of the site prior to construction activities commencing. This documentation will be in the form of photographs or video record.

PZ1.7.3 Duties and Powers of the Environmental Control Officer

The Environmental Control Officer:

- briefs the Contractor about the requirements of the Environmental Specification and/ or Environmental Management Plan, as applicable.
- advises the Employer's Agent about the interpretation, implementation and enforcement of the Environmental Specification and other related environmental matters.
- attends site meetings, as necessary.
- monitors the Constructor's compliance with this specification and the project environmental specification as applicable.
- undertakes periodic audits of the effectiveness of the environmental specifications on the site.
- communicates environmental policy issues to the Employer's Agent.
- provides technical advice relating to environmental issues to the Employer's Agent.
- reports on the performance of the project, in terms of environmental compliance.

PZ1.7.4 Duties and Powers of the Environmental Officer

The Environmental Officer:

- attends site meetings.
- monitors the site for compliance with the Environmental Specification and EMP.
- reports on the performance of the project in terms of environmental compliance to the ECO and Employer's Agent as per the pro-forma attached.
- liaises with the ECO on matters of policy and those requiring clarity and advice.

PZ1.7.5 Extent of the Contractor's Obligations

The Contractor is required to:

- provide information on previous environmental management experience and company environmental policy.
- supply method statements for all activities requiring special attention as specified and/or requested by the Environmental (Control) Officer and/or Employer's Agent during the duration of the Contract.
- be conversant with the requirements of this environmental specification and the project specification as applicable.
- brief his staff about the requirements of the environmental specification.
- comply with requirements of the Environmental (Control) Officer in terms of this specification and the project specification, as applicable, within the time period specified.
- ensure any sub-contractors/ suppliers who are utilised within the context of the contract comply with the environmental requirements of the Employer, in terms of the specifications. The Contractor will be held responsible for non-compliance on their behalf.
- bear the cost of any delays, with no extension of time granted, should he or his SubContractors/ Suppliers contravene the said specifications such that the Employer's Agent orders a suspension of work. The suspension will be enforced until such time as the offending party(ies), procedure, or equipment is corrected.
- bear the costs of any damages/ compensation resulting from non-adherence to the said specifications or written site instructions.
- comply with all applicable legislation in terms of 7.6 below.
- ensure that he informs the Employer's Agent timeously of any foreseeable activities which will require input from the Environmental (Control) Officer.

The Contractor will conduct all activities in a manner that minimises disturbance to directly affected residents and the public in general, and foreseeable impacts on the environment.

PZ1.7.6 Compliance with Applicable Laws

The supreme law of the land is "The Constitution of the Republic of South Africa", which states:

"Every person shall have the right to an environment which is not detrimental to his or her health or well being"

Laws applicable to protection of the environment in terms of Environmental Management (and relating to construction activities) include but are not restricted to:

Animals Protection Act, Act No 71 of 1962

Atmospheric Pollution Prevention Act, No 45 of 1965

Conservation of Agricultural Resources Act, No 43 of 1983
Environmental Conservation Act, No 73 of 1989
Environmental Planning Act, Act No 88 of 1967
Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, No 36 of 1947
Forest Act, No 122 of 1984
Forest and Veld Conservation Act, Act No 13 of 1941
Hazardous Substances Act, No 15 of 1973
Lake Areas Development Act No 34 of 1975
Land Survey Act, No 9 of 1921
Minerals Act, No 50 of 1991
Mountain Catchment Act, No 63 of 1970
National Monuments Act, No 28 of 1969
National Parks Act, No 57 of 1976
National Resources Development Act, Act no 51 of 1947
National Water Act, No 36 of 1998
Occupational Health and Safety Act, No 85 of 1993
Provincial and Local Government Ordinances and Bylaws
Soil Conservation Act, Act No 76 of 1969
Water Services Act No 108 of 1997

and all regulations framed thereunder and amendments there to.

PZ1.7.7Compliance with the Environmental Specification

The Contractor is deemed not to have complied with the Environmental Specification if:

- within the boundaries of the site, site extensions and haul/ access roads there is evidence of contravention of clauses.
- if environmental damage ensues due to negligence.
- the Contractor fails to comply with corrective or other instructions issued by the Employer's Agent within a specified time,
- the Contractor fails to respond adequately to complaints from the public.

Application of a penalty clause will apply for incidents of non-compliance. The penalty imposed will be per incident. Unless stated otherwise in the project specification, the penalties imposed per

incident or violation will be:

Failure to demarcate working servitudes	R1000
Working outside of the demarcated servitude	R2000
Failure to strip topsoil with intact vegetation	R1000
Failure to stockpile topsoil correctly	R500
Failure to stockpile materials in designated areas	R500

Pollution of water bodies (including increased suspended solid loads)	R1000
Failure to control stormwater runoff	R1000
Failure to provide adequate sanitation	R500
Unauthorised removal of woody vegetation	R2000
Failure to erect temporary fences	R500
Failure to provide adequate waste disposal facilities and services	R500
Failure to reinstate disturbed areas within the specified time-frame	R3000
Failure to rehabilitate disturbed areas within the specified time-frame	R3000
Any other contravention of the project specific specification	R400
Any other contravention of the particular (general) environmental specification	R300

PZ2 SITE ESTABLISHMENT AND HOUSEKEEPING

PZ2.1 LAYOUT

The Contractor will take into account any of the limitations identified in the project specification with regard to establishment of site, in particular the location of access routes, and establishment layout.

Notwithstanding the provision of a project specification, the Contractor will provide the Environmental Control Officer with a layout design of the site indicating the position of all of the following, as applicable: offices, ablution facilities, storage areas, workshops, laboratories, batching plant, particulate matter stockpile area (i.e. soil/ granular chemicals/ cement fines etc), waste disposal facilities, hazardous substances storage area, access routes, etc. This layout plan is to be submitted prior to site establishment for acceptance. Any changes to this plan require review by the Employer's Agent in conjunction with the ECO.

The Contractor will take into account prevailing wind directions when designing the site layout to minimise impacts due to dust, unpleasant odours etc.

The Contractor will take into account the positions of residences when designing the site layout in order to minimise noise impacts on the residents.

Site security lighting is to be positioned such that the direct beam is focused away from residential properties and does not pose a nuisance or danger to road users.

No site establishment will be allowed within 100 m of a water body or drainage channel or on a flood plain unless approved by the Environmental (Control) Officer or specified in the project specification.

PZ2.2 SITE CLEARANCE

No trees or shrubs may be removed without the prior permission of the Environmental Officer, unless in keeping with the final site reinstatement and rehabilitation plan.

Topsoil is to be stripped from all areas where permanent or temporary structures and access roads are to be constructed. Topsoil conservation is to be in terms of clause PZ3 5.3 of this document.

PZ2.3 SERVICES

PZ2.3.1 Sanitation

Portable chemical toilets are to be utilised at site unless a connection to sewer is possible or a proper septic tank system is installed. In the case of the septic tank, the installation will require the relevant approvals from the local authority and will require removal upon completion of the contract, unless otherwise directed.

Sanitation facilities will be located within 100 m from any point of work, but not closer than 50 m to a water body.

PZ2.3.2Solid Waste Facilities

Facilities for solid waste collection are to be provided. These are to be at least a 200 l drum and clearly identified as the point for waste disposal.

Waste is to be separated into paper, glass and metal with separate collection points for each. The Contractor will ensure that the appropriate recycling contractors receive this waste.

The Contractor is to institute a daily litter collection programme. The collected waste is to be disposed of regularly and proportionately to its generation at a site designated for waste disposal.

No burning will be permitted on any site unless by approved incineration methods and in a low-risk fire area. In the case of incineration, ash is to be co-disposed with spoil in a designated spoil dump.

No burying of waste will be allowed on any site.

PZ2.3.3Cooking and Heating Facilities

No open fires will be allowed anywhere on site.

Contained fires (i.e. in a fire drum) will be allowed for heating and cooking only in designated areas, in other cases cooking is restricted to gas or electrical equipment.

PZ2.4 FUELS, HAZARDOUS SUBSTANCES AND OTHER LIQUID POLLUTANTS

PZ2.4.1Storage and handling

All potentially hazardous raw and waste materials are to be handled by trained staff and stored on site in accordance with manufacturer's instructions and relevant legal requirements. Hazardous waste shall only be disposed of at an appropriately licenced and registered solid waste disposal facility. The product MSDS is to be lodged with the Employer's Agent.

Storage and handling areas for fuels, lubricants, chemicals and other hazardous substances are to be paved with concrete to prevent accidental contamination of the soil. Alternatively, an impermeable liner may be placed beneath above-ground storage tanks. The integrity of the liner is to remain intact for the duration of the contract, until removal.

Open storage vessels, for example shutter lubricant drums, are to be stored under cover to prevent

'splash' contamination.

All storage areas are to be bunded (with at least sandbags) and have a peripheral collection drain, with oil interceptors (if required).

The bunded area is to be sufficiently large to contain a spillage equivalent to the volume of one container of the substances stored.

All products to be dispensed from 200 litre drums will be done so with appropriate equipment, and not dispensed by tipping of the drum.

Daily checks are to be conducted on the dispensing mechanism of above-ground storage tanks to ensure the timeous identification of faults.

Collection containers (e.g. drip trays) are to be placed under all dispensing mechanisms of hydrocarbon or hazardous liquid substances to ensure contamination from leaks and dispensing is contained.

The dispensing mechanism of diesel and petrol storage tanks is to be stored in a container when not in use.

PZ2.4.2Control of pollutants

A drainage diversion system is to be installed to divert runoff from areas of potential pollution, e.g. batching area, vehicle maintenance area, workshops, chemical and fuel stores, etc if applicable.

Contaminated runoff and wastewater is to be directed into a collection system (e.g. sump, attenuation dam, PVC porta-ponds etc.) for treatment or collection and disposal. The final collection point (e.g. sump) is to be PVC lined.

Collected contaminated runoff/ wastewater is to be pumped out of the final collection point and disposed of at an appropriate landfill site. Sump liners are to be treated in the same manner.

The treated wastewater, effluent and contaminated runoff may require analysis prior to discharge as detailed in the project specification or instructed by the Environmental Officer.

Details regarding proposed methods for treatment of pollutants are to be submitted to the Environmental (Control) Officer for acceptance upon award of the Contract.

Any spillages, irrespective of their size, are to be contained and cleaned up immediately. The Pollution Control section may provide technical assistance for cleanup, if required. No spills may be hosed down into a stormwater drain or sewer.

Use of specialised cleanup techniques and/ or products may be required depending on the spill. This will be instructed by the Environmental Control Officer. These will be to the Contractor's cost.

PZ2.5 GENERAL

Site staff are not permitted to use any open water body or other natural water source (e.g. springs) for purposes of bathing, or the washing of clothes, machinery or vehicles. Nor draw water from a spring without the permission of the community utilising that spring.

PZ3 CONSTRUCTION

PZ3.1 CONSTRUCTION METHODS AND PROGRAMME

PZ3.1.1 Construction Method

The Contractor will provide method statements for construction activities (14 working days prior to the activity commencing) relating to the following environments and those listed in the project environmental specification, unless methods have been prescribed in this or the project environmental specification:

- rivers, streams, or any other open water body.
- wetlands.
- access roads (see PZ3.13 below);
- steep slopes (i.e. steeper than 1:4) or less if friable material is present.
- indigenous bush/ forest.
- close proximity (i.e. 50 m or less) to a residential dwelling.
- drilling and/or blasting of rock.

If a construction method employed by the Contractor is not environmentally acceptable to the Employer, the Contractor may be instructed to cease the utilisation of that method in favour of a more environmentally acceptable one, proposed either by himself or the Employer.

PZ3.1.2 Construction Programme

The Contractor will programme construction so as to minimise the impact on the environment and provide this programme to the Environmental Control Officer for perusal and acceptance at the onset of the contract period. The Environmental Control Officer is to made aware of any amendments to the construction programme or alterations to the scope of work in order that their impacts on the environment can be assessed.

The Contractor shall ensure that all affected landowners/ authorities are advised of the proposed programme at the beginning of the contract period.

PZ3.2 AREAS OCCUPIED / DEMARCATION OF SITE

Routes for temporary access and haul roads are to be located within the approved demarcated areas and vehicle movement is to be confined to these roads. Movement of vehicles outside the designated working areas is not permitted without authorisation from the Employer's Agent.

All construction activities are restricted to working areas designated on the drawings and/or demarcated and approved by the Employer's Agent. Materials including spoil are stockpiled at designated areas.

Any areas disturbed outside of the demarcated areas or without permission of the Environmental (Control) Officer or Employer's Agent will be subject to reinstatement and rehabilitation (as per PZ4 below) to the Contractor's cost.

For the pipeline construction, unless otherwise indicated in the project specification or drawings, a general maximum working servitude width of 20 m will apply for machine excavation for the DN700 pipelines, and a maximum working servitude width of 10 m will apply for machine excavation for the DN200 pipelines. A maximum width of 6 m will apply for manual excavation. These maximum working servitude widths may vary depending on the sensitivity of the environment, as detailed in the project specification.

In sensitive biophysical environments, for example wetlands, indigenous forest / bush, pristine natural grasslands, and sensitive social environments, as defined in the project specification or by the Environmental Control Officer, the working servitude is reduced as indicated in the project specification.

The working servitude shall contain all construction related activities, including, stockpiling of materials, placing of toilets, vehicle movement areas, etc.

Demarcation of linear projects shall be clearly marked, on either side of the linear feature, in all areas where works are occurring. Progressive movement of fencing is required as linear projects progress.

In the case of a fenced site, the boundary fences will be denoted as the outermost limit of the site, but internal areas may be demarcated with stakes as above. The site boundaries of non-fenced, but 'contained' projects are to be delineated using stakes or temporary fencing, depending on the hazard which that site poses.

PZ3.3 SUPPLY OF WORKS FACILITIES

No water may be abstracted from water bodies for the purposes of construction, without approval of the Employer's Agent in consultation with the Environmental Control Officer.

PZ3.5 SITE CLEARANCE

PZ3.5.1 Clearance

Spoil sites will require clearing in addition to those areas in terms of SABS 1200 C 5.1.

The site shall only be cleared immediately prior to construction activities commencing i.e. at the last practicable stage.

No trees or indigenous shrubs may be removed without the prior permission of the Environmental (Control) Officer, unless in keeping with the final site reinstatement and rehabilitation plan.

PZ3.5.2 Disposal of materials

Material obtained from clearing operations shall be disposed of at appropriate municipal disposal facilities. They are not to be disposed of as per Paragraph 1 of Sub-clause 3.1 of SABS 1200 C.

Wood obtained from clearing and grubbing operation remains the property of the landowner/ community and must be stacked at sites designated by relevant person. The Contractor will be required to remove and dispose of any wood from site at a designated site for vegetation disposal, should the landowner/ community not require it.

All tree trunks and branches of diameter greater than 50 mm are to be cut into lengths not exceeding 2400 mm.

Brush wood (i.e. < 50 mm diameter) is to be disposed of, or utilised as specified in the project specification or upon instruction of the Employer's Agent.

PZ3.5.3Conservation of topsoil

The Contractor is required to strip topsoil (as defined in this specification) together with grass, groundcover and sedges from all areas where permanent or temporary structures are located, construction related activities occur, and access roads are to be constructed, etc. The depth to which topsoil will be stripped shall be 200 mm unless stated otherwise in the project specification.

Topsoil is to be handled twice only - once to strip and stockpile, and secondly to replace, level, shape and scarify.

Topsoil is to be replaced along the contour.

Topsoil is to be replaced by direct return (i.e. replaced immediately on the area where construction is complete), rather than stockpiling it for extended periods. This is feasible for progressive construction (e.g. pipelines), but not necessarily so for reservoirs, site establishments, dams, etc.

Topsoil stockpiles are not to exceed 2 m in height.

Topsoil stockpiles are to be maintained in a weed free condition (i.e. no 'broad-leafed' plants regarded as weeds in terms of the Conservation of Agricultural Resources Act No 43 of 1989, or those plants regarded as a 'general nuisance in the area' are to be growing on the stockpiles). The Environmental Control Officer will provide guidance as to which plants are weeds and require removal.

The stockpiles are not to be contaminated with sub-soil, or any other waste material.

Topsoil may not be compacted in any way, nor may any object be placed or stockpiled on it.

Topsoil may not be compacted in any way, nor may any object be placed or stockpiled on it.

Topsoil which is to be stockpiled for periods exceeding 4 months is to be vegetated. In summer a mixture of Eragrotis tef (Teff) and Eragrostis curvula (Weeping Lovegrass) (ratio 1:2) is to be applied at an application rate of 6 kg/ha, unless otherwise instructed in the project specification.

In winter, a mixture of Lolium multiflorum (Annual/Italian Rye grass) and Eragrostis curvula (Weeping Lovegrass) (ratio 1:1) is to be applied at an application rate of 6kg/ha (see PZ4 5.3 for sowing times), unless otherwise instructed in the project specification. Fertiliser is to be applied as per PZ4 5.2.

PZ3.5.4Cutting of trees

Any tree branches which require removal are to be properly pruned and sealant applied to the cut surface, if required.

The Contractor's attention is drawn to Sub-clause 5.2.3.3 of SABS 1200 C with respect to work in indigenous forests.

Any indigenous trees or bush which require removal in terms of the project, and which have not been identified in the project specification or EMP, are to be timeously indicated to the Environmental Officer prior to work affecting them.

PZ3.5.5Landscape Preservation and Conservation of Flora

Notwithstanding Clause 5.7 of SABS 1200 C, the Contractor will be required to transplant designated plants to alternative locations as specified in the project specification or identified by the Environmental Control Officer, upon the instruction of the Employer's Agent.

Transplanting shall be undertaken by employing the following method:

Removal

- Mark the orientation of the tree/shrub (for example, the north-facing side of the trunk indicated by a small arrow made with indelible ink) trunk. Do not scratch a mark on the surface of the trunk;
- Delineate a circle from the trunk with a radius equivalent to the dripline of the tree, or as indicated by the Environmental Control Officer on site.
- Excavate the tree with an intact rootball.

Replanting

- A hole 500 mm larger in diameter than the anticipated rootball must be prepared in advance of the tree removal in order that the tree can be replanted immediately.
- The tree must be positioned as per its original orientation.
- A planting method known as 'puddling' must be employed. This method involves the addition of soil and water simultaneously to expels air from the planting hole. Place the tree in its new hole, making sure the top surface of the rootball is level with the ground level. Place a hose pipe in the hole and leave it running whilst extra soil is added around the rootball.
- 'Compact' the tree in the hole and attach tree stays for stabilisation.

Compensatory planting of species may be required should transplantation not be feasible, as indicated in the project specification or upon instruction of the Employer's Agent.

PZ3.6 EARTHWORKS

PSZ3.6.1 Backfill material

With reference to SABS 1200 DB sub-clause 3.5, no material stripped or excavated which is classed, in terms of this specification, as topsoil, may be used as backfill in any excavation.

PZ3.6.2 Excavation and backfilling

During excavation 'conservation of topsoil', as specified in PZ3 5.3 above will apply.

Excavated material is to be stockpiled along a pipeline trench within the working servitude, unless otherwise authorised.

Surplus excavated soft, intermediate and hard rock material shall not be disposed of along the pipeline trench as indicated in SABS 1200 DB sub-clause 5.6.3 and 5.6.4, but shall be removed to a spoil site (see PZ3.15 below) designated during the project if applicable, or agreed by the Employer's Agent in conjunction with the Environmental Control Officer.

In certain cases, for example to help stabilise the disturbed area or to reinstate the natural aesthetics of an area, excess excavated intermediate and hard material may be disposed of in a designated manner along a pipeline trench, as indicated by the Environmental Control Officer, or in the project specification. In this case, rock material shall not exceed 250 mm in maximum dimension (see PZ4 2.1).

In terms of SABS 1200 DB 5.6.5 and SABS 1200 LB 3.4.2, deficiency of backfill material shall not be made up by excavation within the free haul distance of 0.5 km of site, without the prior approval of the Employer's Agent of the source of the material. Where backfill material is deficient, it should ideally be made up by importation from an approved borrow pit (i.e. one which operates within the ambient of an EMPR.) (See also PZ3 14 below).

The Contractor will backfill in accordance with the requirements of progressive reinstatement.

The maximum length of open trench shall be specified in the project specification.

PZ3.8 Not used

PZ3.8 PLANT

PZ3.8.1 Silencing of plant

With reference to SABS 1200 A amend: "built up areas": to read as "all areas within audible distance of residents (albeit urban, peri-urban or rural areas)."

Appropriate directional and intensity settings are to be maintained on all hooters and sirens.

Silencer units on equipment and vehicles are to be maintained in good working order.

Construction activities are to be confined to normal working hours as defined in the specification.

PZ3.8.2 Appropriate use of plant

The Contractor will at all times use plant which is appropriate to the task in order to minimise the extent of damage to the environment.

PZ3.9 DEALING WITH WATER ON WORKS

PZ3.9.1 Disinfection of Potable Water Infrastructure

Disinfection water is to be neutralised before release of this water to the environment.

PZ3.9.2 Discharge of water from site

Any water which is discharged from site is to comply with the relevant Water Quality Guidelines implemented by DWA.

Water discharged to the stormwater / sewer system may only be done so with the permission of the relevant local authority.

PZ3.10 CONTROL OF EROSION

Surface erosion protection measures will be required to prevent erosion where slopes are steeper than 1:8 on all soil types.

Erosion protection measures required may include all or some of the below, as specified in the project specification or upon instruction of the Employer's Agent in conjunction with the Environmental (Control) Officer:

- use of groundcover or grass
- construction of cut off berms (earth and/or rockpack) - these are to be angled across the contour and normally would approximate an angle of 30o from the bisector of the contour.
- placing of brush wood on bare surface.
- pegging of wattle trunks or branches along the contour.
- hard landscaping, e.g. use of Loffelstein walls, ground anchors, gabions etc.

Scour chambers are to be fitted with energy dissipaters, or the jet of water directed onto a protected (i.e. grouted stone pitching/ rock pack/ reno mattress) area to dissipate water velocity and to control and prevent erosion.

Storm water drainage measures might be required on site to control runoff and prevent erosion.

PZ3.11 CONTROL OF POLLUTION

No waste in a solid, liquid or gaseous state shall be emitted from or spilled on the site without the approval of the Employer's Agent.

No mixed concrete shall be deposited directly onto the ground prior to placing. A board or other suitable platform is to be provided onto which the mixed concrete can be deposited whilst it awaits placing.

Excess concrete from mixing shall be deposited in a designated area awaiting removal to an approved landfill site.

The Contractor will contain wash water from cement mixing operations, by directing the water into a sump for collection. The material contained in the sump will be removed to an appropriate landfill site.

No concrete rubble shall be present at the site.

Liquid wastes will not be disposed of to storm water drains. They may be disposed of to sewer only if permitted by (local council) legislation.

In the event of pollution of a water body (including sediment loading), the Contractor will provide alternative water supply to users of that water body until the quality of the water body is restored to its previous unpolluted state. For the sake of this clause, pollution is deemed to be a state which is substandard to the normal quality of the water body, but is not necessarily in contravention of the South African Water Quality guideline standards for a prescribed activity.

Any ancillary damages resulting from pollution of a water body will be repaired / remediated at the Contractor's cost.

Where, due to construction requirements, pollution of a water body may potentially occur, the Contractor is to ensure adequate measures (e.g. attenuation/ settlement dams / oil absorbent products) are in place to prevent pollution. A method statement is to be provided to this effect (see PZ3 1).

PZ3.12 CONTROL OF FIRE

The Contractor will ensure he has the necessary firefighting equipment on site in terms of SABS 1200. This will include at least rubber beaters when working in 'veld' areas, and at least one fire extinguisher of the appropriate type when welding activities are undertaken, irrespective of the site.

PZ3.13 USE AND MAINTENANCE OF ACCESS FACILITIES

PZ3.13.1Responsibility

The Employer's Agent [not the Contractor (SABS 1200 AD 5.3.1)] will be responsible for obtaining permission for temporary and permanent rights of way over all private property affected by project activities.

The Contractor shall be responsible to keep a photographic record of all access facilities and that these are reinstated to a state not worse than upon commencement of the project and to the satisfaction of the landowner (not withstanding that the project's objective is not to upgrade landowners' access roads).

PZ3.13.2Fencing

Temporary fencing is to consist of 1.2 m bonnox fencing, or similar, suitably tensioned and supported on 1.8 m fencing standards at 3 m intervals, with all necessary straining posts and stays.

All temporary fencing as indicated by the Employer's Agent is removed on completion of the contract.

PZ3.13.3New Access Roads

Any construction roads created for execution of the project are to be designed to incorporate adequate drainage and water attenuation structures.

Any access roads which incorporate 'cut and fill' aspects and/or which are to be surfaced during construction are to be authorised by the Environmental Control Officer. Prior to construction of the road, the Contractor will be required to provide a sketch plan of the road layout (referenced to local topographic, natural and man-made structures). Slope steepness, road width, drainage structures and their frequency will need to be documented and accompany the sketch layout.

Construction access roads may not be wider than that necessary (maximum width 4 m) for movement of vehicles in one direction only. Should two-way traffic be required, points people are to control

vehicle movement on the 'single lane' road or passing bays are to be used where specified in the project specification or as identified by the Employer's Agent in conjunction with the Environmental Control Officer, unless otherwise stated in the project specification.

The cut and fill slopes of permanent roads will require grassing, as specified in the project specification or by the Environmental Control Officer, to increase stability and reduce aesthetic impacts. Hard landscaping may be required as per the project specification.

Temporary construction roads will require rehabilitation on completion of construction activities for which they were required. These roads will require rehabilitation as per PZ4 4 or as specified in the project specification. In the case of access 'tracks', only ripping to loosen compaction will be required unless otherwise stated by the Environmental Control Officer or project specification.

Access roads created by the project may only remain unrehabilitated on written request of the landowner, with his acceptance of the state of the road and a clause that the landowner accepts all responsibility for the road and its state.

PZ3.13.4 Maintenance of Existing Access Roads

The Contractor will record, photographically, the state of existing roads which are to be used for access, prior to plant utilising these roads.

During the contract period, the Contractor will ensure that all existing water attenuation and drainage structures are maintained in a state in which they can optimally perform their function.

Upon completion of the construction period, the Contractor will ensure that the access roads are returned to a state not worse than prior to construction commencing.

PZ3.14 BORROW PITS

Where the Contractor is required to import material this shall be from commercial sources or borrow areas specified in the project specification.

The Contractor may source material from alternative borrow pits provided: the site location; method of winning material and reinstatement and rehabilitation are environmentally acceptable and approved by the Environmental Control Officer.

In this regard, the Contractor shall give the Environmental Control Officer in writing, 30 days prior to opening up alternative borrow pits the following information for acceptance:

- quantities of borrow material required.
- method statement for excavation of material including depth and extent of excavation.
- anticipated 'active life' of the borrow area.
- proposal for reinstatement and rehabilitation of borrow area, including final profile.
- written approval from the landowner/ relevant authority that material may be removed from their land subject to their stated conditions, requirements, and royalties, and if the proposal is acceptable to the Environmental Control Officer.

Development and rehabilitation of borrow pit areas are likely to include the following activities (but these must not be regarded as exhaustive):

- Stripping and stockpiling of topsoil as per PZ3 5.3 of this specification.
- Removal (to nominal depth of 500 mm) and stockpiling of sub-soil.
- Infill of borrow pit with spoil material.
- Contouring of borrow pit to approximate natural topography and/ or reduce erosion impacts on the site.
- Placement of excavated subsoil over spoil material.
- Placement of stripped topsoil on subsoil.
- Grassing of topsoil in terms of clause PZ4 4 of this specification.

The Contractor is to familiarise himself with the requirements of the Minerals Act No 50 of 1991 in terms of borrow pit development, and the requirements of the EMPR, as applicable.

PZ3.15 SPOIL SITES

Where the Contractor is required to spoil material, spoil sites must be identified which are environmentally acceptable and approved by the ECO, unless spoil site areas have been identified in the project specification, in which case these will be the designated spoil sites.

If no spoil sites have been previously identified together with reinstatement and rehabilitation criteria, the Contractor is to provide the following information to the ECO at least 30 days prior to requiring sites to spoil material:

- the location, description of and access to alternative sites identified in order that they may be assessed.
- the quantity of material to be spoiled.
- the type of material to be spoiled (i.e. blast rock/ excavated rock/ soft shale/ subsoil etc.).
- the proposed method of spoiling.
- the proposed reinstatement and rehabilitation plan including final profile.
- written approval from the landowner/ relevant authority that material may be spoilt on land subject to their stated conditions and requirements and if the proposal is acceptable to the ECO.

Development and rehabilitation of spoil areas are likely to include the following activities (but these must not be regarded as exhaustive):

- Stripping and stockpiling of topsoil as per PZ3 5.3 of this specification.
- Removal (to nominal depth of 500 mm) and stockpiling of sub-soil.
- Placement of spoil material.
- Contouring of spoil site to approximate natural topography and/ or reduce erosion impacts on the site.
- Placement of excavated subsoil over spoil material.
- Placement of stripped topsoil on subsoil.

Grassing of topsoil in terms of clause PZ4 4 of this specification.

PZ3.16 NUISANCE

PZ3.16.1 Dust

At all times the Contractor shall control dust on the site, access roads, borrow pits and spoil dumps with water, chemical soil stabilisers or temporary surfacing as specified in the project specification or upon instruction of the Employer's Agent.

Dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments. These impacts include visual pollution, decreased safety due to reduced visibility, health aspects, and ecological impacts due to dust particle accumulation.

On gravel or earth roads, vehicle speeds may not exceed 30 km per hour.

PZ3.16.2Noise

The operational layout of the construction site is to be designed to control and reduce noise from source (see clause PZ2 1).

Machinery and vehicle silencer units are to be maintained in good working order. Offending machinery and /or vehicles will be banned from use on site until they have been repaired.

Construction activities generating output levels of 85 dB(A) or more (excessively noisy), in residential areas, are to be confined to working hours (08h00 - 17h00) Friday s to Fridays only.

'Normal' or 'noisy' working hours may only be extended with the prior written approval of the Employer's Agent, who shall have been notified, at least 7 days in advance, of the impending work requiring extension.

The Employer's Agent and the ISD Office will ensure that the neighbours are timeously forewarned of imminent noisy activities.

Should community complaints be received with regard to noise generation, the Contractor will, at the discretion of the Employer's Agent and Environmental Control Officer, provide an independent and registered noise monitor to undertake a survey of noise output levels from site, and implement measures to reduce noise to legislated levels.

PZ3.16.3Visual

All site establishment components, as well as equipment, will be positioned to limit visual intrusion to neighbours (see clause PZ2 1 above).

The type and colour of roofing and cladding materials are to be selected to reduce reflection.

Security lighting (both temporary and permanent) and lighting required for specific works activities must be placed such that it is not a nuisance to residents and the general public.

PZ3.16.4Interference with neighbours and public

No construction staff may approach site neighbours, for whatever reason, without the knowledge and permission of the Employer's Agent.

Complaints from neighbours and public with regard to interference from contract staff will be regarded in a serious light, and the offender(s) may be subject to disciplinary action.

PZ3.16.5 Disruption of Services

Disruption of services, e.g. road access, water and electricity, must be kept to a minimum at all times.

Where service disruption is unavoidable, the Contractor is to advise the Employer's Agent (at least 7 days in advance), who in turn will timeously warn the affected parties.

PZ3.17 SPECIAL ENVIRONMENTS

PZ3.17.1 Wetlands

Pipeline trenches which traverse wetlands shall be constructed as specified in the project specification. The Contractor will submit a method statement for work in wetland areas as per PZ3.1.1

Construction may not permanently alter the surface or subsurface flow of water through the wetland.

The Contractor shall submit a method statement for review at least 14 days prior to commencing construction in a wetland.

The Contractor will remove all wetland vegetation with their root ball intact. This vegetation is to be kept moist at all times. It is to be placed in the shade and covered with moistened hessian cloth until replanting, which is to be undertaken immediately surface reinstatement is complete.

No construction materials may be stockpiled in any wetland areas.

The pre-construction profile of the wetland shall be returned to one similar as before construction, with no created "ridge or channel" features present.

PZ3.17.2 River/ stream courses

The Contractor shall submit a method statement for review 14 days prior to commencing construction. The method statement should highlight (but not be confined to) the following issues:

- detailed plan of crossing including pipe protection works.
- how water flow will be diverted during construction (if applicable);
- containment of contaminated runoff and wastewater.
- width of working servitude (if not already detailed in project specification);
- final expected profile of river/ stream banks.
- reinstatement and rehabilitation of river/ stream banks.

The Contractor will remove herbaceous riparian vegetation as indicated in the project specification or by the Environmental Control Officer, with their root ball intact. This vegetation is to be kept moist by means of placing it in the shade, covered with moistened hessian cloth until it is replanted.

The Contractor shall not modify the banks or bed of a water course unless as specified in the project specification.

Rocks for use in gabion baskets/reno mattresses may not be obtained from a water course.

The Contractor will not pollute any water body as a result of construction activities (see also PZ3.11).

The Contractor shall not cause any physical damage to any aspects of a water course, other than those necessary to complete the works as specified and in accordance with the accepted method statement

Where a stream or river crossing requires the diversion of water, a method statement is to be provided to the Environmental Control Officer in this regard for review.

PZ4 REINSTATEMENT AND REHABILITATION

Scope: Generally, reinstatement shall be carried out by a specialist environmental rehabilitation firm as a sub-contract to the Main Contract. This section is provided for illustrative purposes to enable the Contractor to anticipate, and work in conjunction with, the reinstatement efforts.

The actions and approach of the Contractor are of crucial importance in the success of the reinstatement and rehabilitation, with the objective to ensure that the condition of the areas disturbed by the project are returned to a state that approximates what they were before the project or better, within reason.

Any rehabilitation plan submitted in this regard will supersede this section PZ4 once approved by the Employer.

The concept of progressive reinstatement is fundamental to cost effective (both financial and environmental) rehabilitation of a site. This concept must be followed at all times. Where landscaping is utilised, the concept is to utilise and restore indigenous plants to the site, in terms of the concept of xeriscaping.

Reinstatement will be required for all areas disturbed by the project. For pipeline projects, this will include the full working servitude, not just the top of actual excavation as per SABS 1200 DB (subclause 5.9.1.1).

The Contractor will reinstate and rehabilitate all disturbed areas outside of the demarcated working area (as defined in terms of clause PZ3 2 or the project specification) at his own cost and to the satisfaction of the Environmental Control Officer and Employer's Agent.

PZ4.1 HOUSEKEEPING

All areas are to be cleared of rubble associated with construction. This includes the removal of surplus materials, excavation and disposal of consolidated waste concrete and concrete wash water, litter, etc.

All soil contaminated by hydrocarbons, for example from leaking machines, refuelling spills etc., is to be excavated to the depth of contaminant penetration, placed in 200 litre drums and removed to an appropriate landfill site.

PZ4.2 FINISHING

PZ4.2.1 Final Grading

Final levels of all disturbed areas are, where feasible in terms of the project requirement, to be consistent with the natural topography of the area.

In certain instances, it will be acceptable to reinstate rock onto a works area (e.g. pipeline servitude), provided that that rock does not exceed 250 mm in maximum dimension and is placed in a manner consistent with the natural surrounds as indicated by the Environmental Control Officer and Employer's Agent.

All drainage lines affected by construction are to be reinstated to approximate their original profile. Where this is not feasible due to technical constraints, the profile is to be agreed upon by the Environmental Control Officer and Employer's Agent.

All compacted (disturbed) areas (including stockpile areas) are to be ripped (along contour) to a depth of 150 mm prior to the replacement of topsoil.

PZ4.2.2 Topsoiling

Topsoil is to be replaced to a minimum depth of 100 mm or as otherwise stipulated in the specification.

Topsoil is not to be compacted, but once replaced is to be scarified (to a depth of 50mm) consistent with the natural contour.

If insufficient topsoil is available, subsoil or similar material may be used that may be a suitable substrate after addition of soil improving substances e.g. compost, pH rectifiers (lime or gypsum) etc. Soil testing may be required at an approved facility.

PZ4.3 REINSTATEMENT OF WATER COURSES AND WETLAND AREAS

The Contractor will ensure that water course banks are returned to their original profile unless the project specification states otherwise.

The surface reinstatement of wetland areas is to ensure that no depressions remain which could act as channels for preferential water flow thereby affecting the hydrological regime of the wetland.

The Contractor will preserve all riparian and wetland vegetation for use in rehabilitation of those environments. This vegetation is to be kept moist at all times. It is to be placed in the shade and covered with moistened hessian cloth until replanting, which is to be undertaken immediately surface reinstatement is complete.

Plants are to be, as nearly as possible, replanted in areas from which they were removed.

PZ4.4 VEGETATION RE-ESTABLISHMENT

The Contractor will ensure that all areas disturbed by contract activities are revegetated to the specified standard.

This standard is deemed to be an 85 % cover with no areas in excess of 0.04 m^2 / m^2 remaining unvegetated.

Revegetation shall match the vegetation type which previously existed (e.g. kikuyu pastures are to be returned to kikuyu pasture; 'veld' grass to 'veld' grass, etc.), unless stated otherwise in the project specification.

Prior to re-grassing, and if required:

- the area is to be scarified or ripped (along contour) to a depth of 50 mm to loosen compaction.
- weeds present on site are to be removed.

Re-grassing, where required, will be either by means of seeding, instant turf (sods), sprigs or plugs as specified in the project specification or as specified by the ECO.

Where sprigs or plugs are utilised, they are to be planted at 200 mm centres. The fertiliser shall be applied as per PZ4 5.2. During summer, 25mm of irrigation shall be applied each week until reasonable (60%) ground cover has been obtained. During winter 15mm of irrigation shall be applied each week until reasonable (60%) ground cover has been obtained. The amount of irrigation to be applied will make up the difference between rainfall recorded on site and minimum requirement.

Where instant turf is utilised, it shall be laid as specified in the project specification. The fertiliser shall be applied as per PZ4 5.2. During summer, 25mm of irrigation shall be applied each week until all the turf is visibly growing. During winter 15mm of irrigation shall be applied each week until all the turf is visibly growing. The amount of irrigation to be applied will make up the difference between rainfall recorded on site and minimum requirement.

Grassing shall be undertaken by a specialist grassing Sub-contractor, unless permission is granted otherwise by the Employer's Agent upon receipt of a written motivation from the Contractor.

The Contractor shall state in writing when the regrassing operation will commence and its expected duration (dates).

Grassing in 'veld' areas is to be undertaken as per PZ4 5 below. Cynodon dactylon species may be excluded or substituted from this mixture at the discretion of the Environmental Control Officer, or as specified in the project specification. The seed bulk may be made up with the Eragrostis tef.

PZ4.5 "VELD GRASS" GRASSING SPECIFICATION

The area to be grassed should be estimated and converted to hectares,

e.g. 100m X 100m = 10 000m^2 = 1ha. All fertilizer and seeding rates used in this specification are with respect to hectares.

PZ4.5.1 Regional areas

For re-grassing three distinctive areas exist. These are defined as:

- the Coastal area (a narrow band running from the coast to ≈15km inland of the coast)
- the Coastal hinterland (a broad band (≈50km wide), generally defined as westwards of the coastal belt, and below 800m a.s.l.)

PZ4.5.2 Fertiliser

Standard 2:3:2 (N:P:K) fertiliser shall be used on all sites.

The rate of application will be:

- 200 kg/ha in the Coastal Hinterland areas, and
- 300 kg/ha in the Coastal areas.

PZ4.5.3 Planting times

Summer (includes Spring) is considered to be between the 1 September and 28 (29) February.

Winter (includes Autumn) is considered to be between 1 March and 31 August.

Re-grassing will be undertaken (as far as possible) in summer as germination and establishment of grasses is most effective, assuming reasonable spring rains.

Vegetation re-establishment is likely in many cases to be held off until this suitable growing season.

Hydroseeding with a winter mix will only be specified where regrassing is urgently required and cannot wait until the summer season. In this case irrigation will be required as per PZ4 5.4 below.

PZ4.5.4 Establishment and maintenance

During summer, 25mm of irrigation shall be applied each week until reasonable (60%) ground cover has been obtained.

During winter (where annual rye grass is specified) 15mm of irrigation shall be applied each week until reasonable (60%) ground cover has been obtained.

If rapid establishment is required, additional watering may be necessary as specified in the project specification

The amount of irrigation to be applied will make up the difference between rainfall recorded on site and the minimum requirement.

PZ4.5.5 Grass Seed Selection and Application Rates

The specific seed selection and application rates for each of the defined areas are covered separately, as follows.

PZ4.5.5.1 Coastal area

Summer mix (1 September - 28 February)

Grass species	**Common name**	**General application rate (kg/ha)**
Eragrostis tef	Teff	5
Eragrostis curvula	Weeping lovegrass	10
Chloris gayana	Rhodes grass	10
Digitaria eriantha	Smuts' fingergrass	5
Total		30

Winter mix (1 March - 31 August)

Grass species	**Common name**	**General application rate (kg/ha)**
Lolium multiflorum cultivar - Midmar	Annual/Italian rye grass	10

Eragrostis curvula	Weeping lovegrass	10
Chloris gayana	Rhodes grass	5
Total		25

PZ4.5.5.2 Coastal hinterland.

Summer mix (1 September - 28 February)

Grass species	**Common name**	**General application rate (kg/ha)**
Eragrostis tef	Teff	5
Eragrostis curvula	Weeping lovegrass	10
Chloris gayana	Rhodes grass	10
Cenchrus ciliarus	Blue buffalo grass	2
Cynodon dactylon	Couch/Kweek/Star grass	10
Total		37

Winter mix (1 March - 31 August)

Grass species	**Common name**	**General application rate (kg/ha)**
Lolium multiflorum cultivar - Midmar	Annual/Italian rye grass	10
Eragrostis curvula	Weeping lovegrass	10
Chloris gayana	Rhodes grass	5
Cenchrus ciliarus	Blue buffalo grass	2
Cynodon dactylon	Couch/Kweek/Star grass	3
Total		30

PZ4.5.6 Seeding methods

Two methods are recommended, namely hydroseeding and hand-broadcasting. The required method shall be as specified in the project specification.

All seed supplied should be labelled in accordance with the Government Seed Act No. 20 of 1961 and the Contractor shall be required to produce such certification, if requested by the Employer's Agent.

PZ4.5.6.1Hydroseeding

The Grassing Contractor shall be conversant with this method.

Cellulose pulp (consisting of either wood shavings, shredded straw, shredded paper or cotton waste) shall be added to the mix to be applied at a rate of 250 kg/ha.

In addition to the cellulose pulp, compost (consisting of either chicken litter, kraal manure, sugar cane filter cake or mushroom compost) shall be incorporated at a rate of 5m3/ha (?100 X 50kg fertiliser bags/ha).

PZ4.5.6.2Hand-broadcasting

Fertiliser, at the appropriate rate, is to be distributed by hand in a manner to ensure that there is an even spread of fertiliser over the site. This is to be done prior to seeding.

The seed mix is to be weighed and made up in an appropriately large container which shall be stirred to ensure no settling out of the grass seed, and a uniform distribution of the different types of seed.

The seed is to distributed by hand in a regular grid broadcasting manner to ensure that there is an even spread of grass over the entire site.

The area seeded is to be raked over once the seed and fertiliser have been applied to incorporate these elements into the topsoil.

PZ4.5.7 General

Where there is a possibility of neighbourhood livestock grazing a rehabilitated site, these should, as far as is practicable, be excluded for the first 3 months of re-grassing.

PZ4.6 LANDSCAPING

Landscaping of the site may be required as indicated in the project specification.

Compensatory planting of trees or shrubs may be required should the transplantation of such not be successful in terms of PZ3 5.5 or due to plants removed in terms of PZ3 5.4 Planting of trees will be in accordance with the following method:

- All tree holes shall be square in plan;
- Tree holes shall be a minimum of 600 mm by 600 mm square by 700 mm deep;
- Holes are to be backfilled with excavated soil in a ratio of 3:1 with compost. The compost is to be weed free and have been composted at temperatures in the order of 65°C. Where possible, any available topsoil should be placed in the hole at the level where the tree rootball will rest. A handful (half-a-cup) of each Superphosphate and 2.3.2 should be mixed into the soil-compost mix;
- The tree holes are to be backfilled to the point where the tree and its rootball are in the desired position. The tree is to be removed temporarily, and the hole filled with water and allowed to drain away. This operation of watering and draining should be repeated at least four times in order that the surrounding ground and hole are thoroughly moist. The tree is then to be replaced, and the remaining soil replaced;
- All trees shall be tied (using a tree tie) to a suitable timber stake planted in the ground to a depth of at least 500 mm. The stake shall have a minimum diameter of 35 mm and shall be at least 300 mm higher than the planted tree;
- Water retaining basins of at least 500 mm diameters are to be formed around each tree;
- The Contractor is to apply at least 10 litres of water per tree per fortnight for a period of at least 3 months.

The planting of shrubs will be in accordance with the tree planting method with the exception that the holes are to be a minimum of 400 mm by 400 mm square by 500 mm deep, and that the tree stakes and ties are not required.

PZ4.7 ALIEN PLANT CONTROL

All sites disturbed by construction activities will be monitored for colonisation by invasive alien plant species.

The Environmental Control Officer will identify those plants which require removal during both the construction and maintenance period, for the Contractor's action.

The Environmental Control Officer will provide advice as to effective methods of removal and control of alien plant species.

PUBLIC COMPLAINTS REGISTER

DATE	COMPLAINANTS NAME	DESIGNATION/ AFFILIATION	REASON FOR COMPLAINT	ACTION TAKEN	ACTION BY	ACTION BY DATE	ACHIEVED BY DATE	DATE REFERRED TO NW environmental control officer

PROJECT NAME: **CONTRACT NO.**

DATE OF SITE INSPECTIONS DURING REPORTING PERIOD:

Specification Breach	Spec. No.	Remedial Action Recommended	Due Date	Authority Responsible	Action Taken

PUBLIC COMPLAINTS

Complainant	Designation/ Affiliation	Date of complaint	Reason for Complaint	Action taken and date

C4.1 GEOTECHNICAL

Refer to attached Detailed Geotechnical Report, the contractor shall refer to the attached geotechnical report when pricing for excavations for reservoirs and pipelines and shall provide an all-inclusive rate to cater for construction methods based on the underlying soil conditions to ensure works are completed as per specifications

IGNEOUS SOIL LABORATORY
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GEOTECHNICAL INVESTIGATIVE REPORT FOR THE HLUHLUWE PHASE 02 RESERVOIR AND RETICULATIONS UPGRADE AT HLUHLUWE VILLAGE LOCATED IN UMKHANYAKUDE DISTRICT MUNICIPALITY IN THE KWA-ZULU NATAL PROVINCE.

PREPARED FOR:

Zimile Head Office

International Business Gateway Office Park

Cnr Pioneer Avenue & Elizabeth Rd, Midridge Park

Midrand, South Africa, 1685.

REPORT REFERENCE NUMBER:
QOJ 987-Revision 3

DATE:
24 October 2025

EXECUTIVE SUMMARY

Igneous soil Laboratory was appointed by Zimile on the 20th of August 2025, to undertake the detailed geotechnical investigation for the Hluhluwe phase 02 reservoir and reticulations upgrade at Hluhluwe village located In uMkhanyakude District Municipality in the Kwa-Zulu Natal Province.

According to the 1:250 000 scale 2832 St. Lucia geological map published by the Council for Geoscience; the site is underlain by the complex geological setting consisting of the older Karoo Supergroup and the younger Quaternary Sediments.

The karoo Supergroup Geology/Older deposits consist of fine-grained sandstone and siltstone, which can be weathered and friable of the Clarens formation. The overlying Drakensberg Formation is composed of basaltic lava flows, forming a more competent, though often fractured, bedrock.

The Quaternary Sediments has a lithological structure of Sandy or clayey colluvial and alluvial sediments and palaeosols, red decalcified sand in inland dune cordons, conglomerate, coquina, calcarenite, redistributed sand of the Maputaland Group a succession of late Cenozoic littoral marine deposits and is in close proximity with Fossiliferous glauconitic siltstone and fine-grained sandstone, conglomeratic towards the base of the St. Lucia .

The geotechnical investigations involved field inspections, a review of available data, a comprehensive test pit excavation programme, soil profiling, in-situ testing, the sampling of disturbed samples, testing of soil materials and reporting findings from the geotechnical investigation.

Groundwater seepage was encountered on Tp05 and Tp06 at 300 ND Steel Rising Main Slightly moist to wet conditions were encountered in all test pits excavated. Generally, the soil profiles were comprised of transported and residual material.

The study area consists of transported and residual soil material. The transported soil material is generally slightly moist, Brown, loose, pinhole, silty SAND, with grass Roots. The residual soil material is generally moist, brown, loose to medium dense, Intact, silty sand.

In general, the site is underlain by material with good compaction characteristics. The soils classified as material of **G9 and <G9** quality. Material for pavement of road should be sourced from a commercial source due to limited quantities of better than G6 material.

The implementation of an efficient surface drainage system is recommended around all structures and along all roads throughout the study area. Suitable measures must be implemented to mitigate the possible rising damp challenges.

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DOCUMENT APPROVAL RECORD

ACTION	FUNCTION	NAME	DATE	PRACTICE No. (SACNASP)	SIGNATURE
Document Compilation	Engineering Geologist	Aluwani Mboye	24-10-2025	166870	

RECORD OF REVISIONS AND ISSUES REGISTER

Date	Revision	Description	Issued to	Issue Format	No. Copies	Signature
24-10-2025	3	Desktop study Report	Mr Nhlanhla Gumede	Soft copy	1	

General limitations:

1. The investigation has been conducted in accordance with generally accepted engineering practice, and the opinions and conclusions expressed in the report are made in good faith based on the information at hand at the time of reporting.

2. The contents of this report are valid as of the date of preparation. However, changes in the condition of the site can occur over time as a result or either natural processes or human activity. In addition, advancements in the practice of geotechnical engineering and changes in applicable practice codes may affect the validity of this report. Consequently, this report should not be relied upon after an eclipsed period of one year without a review by this firm for verification of validity.

3. Unless otherwise stated, the investigation did not include any specialist studies, including but not limited to the evaluation or assessment of any potential environmental hazards or groundwater contamination that may be present.

4. The investigation is conducted within the constraints of the budget and time and therefore limited information was available. Field observations were conducted solely by Igneous Soil Laboratory field team, and not the author of this report. The nature and extent of variations across the site may not become evident until the time of construction. Possible variations could affect the proposed project adversely, and it may be necessary to re-evaluate recommendations in this report. Therefore, it is recommended that Igneous Soil Laboratory be retained to provide specialist geotechnical engineering services during construction to observe compliance with the design concepts, specifications and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to commencement of construction. Any significant deviation from the expected geotechnical conditions should be brought to the author's attention for further investigation.

5. The assessment and interpretation of the geotechnical information and the design of structures and services and the management of risk is the responsibility of the appointed engineer.

1. INTRODUCTION

1.1. Background

Igneous soil Laboratory was appointed by Zimile on the 20th of August 2025, to undertake the detailed geotechnical investigation for the Hluhluwe phase 02 reservoir and reticulations upgrade at Hluhluwe village located In uMkhanyakude District Municipality in the Kwa-Zulu Natal Province.

This report presents a geotechnical desktop study for the Hluhluwe area within the uMkhanyakude District Municipality. The study synthesizes publicly available data to provide a preliminary assessment of the site's ground conditions, potential hazards, and geotechnical risks for future development.

1.2. Purpose

The purpose of the geotechnical investigation is to assess the underlying soil conditions at Hluhluwe area for the strengthening project. The investigation will entail assessing the soil profile and obtaining the soil engineering parameters for the design of the terrace and the foundations.

1.3. Scope of Work

The detailed geotechnical investigation will include the following:

- Site geology and stratigraphy.
- Soil and rock classification.
- Identification of geotechnical problems.
- Earthworks and terrace construction recommendations
- Excavatability of material on site as per SANS1200 specifications
- Establish the sources available to obtain the G6/G7 material for fill
- Comment on cost estimates for construction of final design
- Structural design requirements of the fill
- Recommended foundation solutions

The investigation will present practical recommendations for site preparation (earthworks and terracing), as well as the design and construction of foundations.

Pipelines

- Construction of new 3km long 300mm ND steel rising main from the existing WTW to the new 4Ml Command Reservoir Site
- Construction of new 6km long 355mm ND gravity main
- Construction of new 1km long 200mm ND gravity main
- Construction of new 2km long 90mm ND gravity main
- Construction of new 1.6km long 200mm ND reticulation main
- Construction of new 1.4km long 315mm ND reticulation main

Reservoirs

- Construction of new 1Mℓ reservoir at the WTW Plant
- Construction of new 4Mℓ command reservoir
- Construction of a new 3Mℓ service reservoir

1.4. Available information

The following sources of information were utilized:

- 1:250 000-scale 2832 Geological Map (1986).
- 1:50 000-scale 2832AB_BC Hluhluwe Topographic Maps.
- Google satellite image.
- Technical Recommendations for Highways – TRH14 Guidelines for Road
- Construction Materials by the National Institute for Transport and road research of the Council for Scientific and Industrial Research, (1985).
- SAICE's Guidelines for Urban Engineering Geological Investigations.
- SANS 10160-5 for Southern African seismic activity.

2. FACTUAL REPORT

2.1. Site Description

The study area is located in Hluhluwe In Um-khanyakude District Municipality in the Kwa-Zulu Natal Province, South Africa. The investigation area is located along the N2 national route with approximate centre coordinates: Latitude **28°10'56.40"S** and Longitude **32°17'52.17"E**.



Igneous Soil Laboratory

CLIENT:
Zimile Consulting Engineers

PROJECT:
Hluhluwe, Umkhanyakude Disctrict Municipality
Locality Map

Project No.: QOJ 987.
Date: 20/08/2025

Map Scale: 100m
Georef: Google Earth

Figure 1: Site location of the study area.

2.2. Climate and Weather

Hluhluwe's climate is classified as tropical. In Hluhluwe, the level of precipitation during summers surpasses that of winters. Köppen and Geiger classify this climate as Aw. The mean temperature prevailing in the city of Hluhluwe is recorded as 22.0 °C, according to statistical data. The precipitation level on a yearly basis amount to 837 mm as per the meteorological records.

According to the Weinert 1980, the study area has a climatic N-Value of less than 2 This is an indication that climate in the region is wet. The mode of weathering is therefore mainly chemical weathering (decomposition). Montmorillonite change to kaolinite in topsoil layers and deep weathering profile is expected.

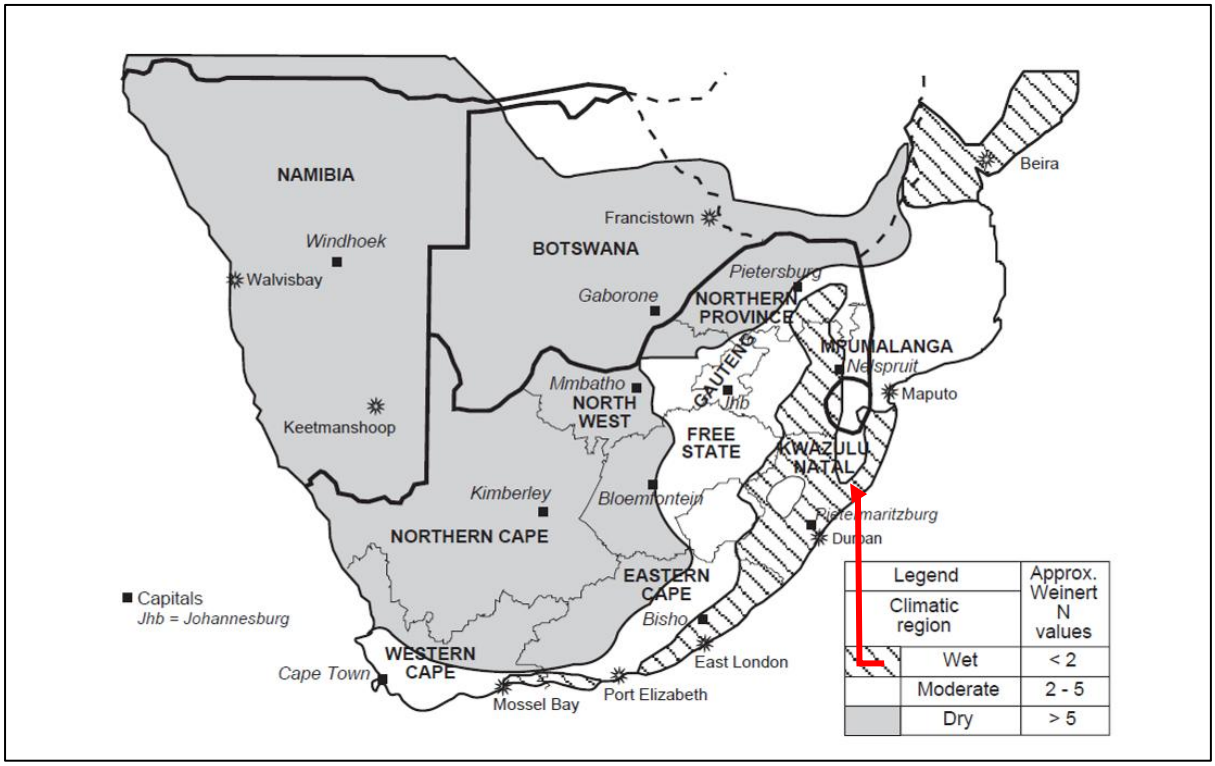


Figure 2: Macro-climatic regions of Southern Africa (source: adapted from Weinert, 1980)

Table 1 Weathering characteristics as influenced by climate (Weinert, 1980)

N-value	Mode of weathering	Weathering characteristics	Principle secondary minerals
>10	Mainly disintegration	Thin weathering layer, No secondary minerals	Almost none
5-10		Few secondary minerals	Hydromica, illite
2-5	Mainly decomposition	Weathering profile deepens towards N=2, significant secondary minerals	Kaolinite, Montmorillonite
<2		Montmorillonite changes to Kaolinite in top soil layers, deep weathering profile	Kaolinite, Montmorillonite
<1		Montmorillonite and kaolinite change to sesquioxides, very deep weathering profiles	Kaolinite, Sesquioxides

2.3. Topography and drainage

According to the topographic map 2832AB_BC Hluhluwe, suggest that the topography of the site consists of rolling hills, high ridges, and deep valleys carved by river systems, including the Hluhluwe River. The slopes can be steep in certain areas, which is a key consideration for any geotechnical investigation or construction.

The contour lines on the Topographic map show that the site has steep slope of an average of 3.1 % from East to West. The site slope was calculated using a topographical map with the aid of Google Earth).

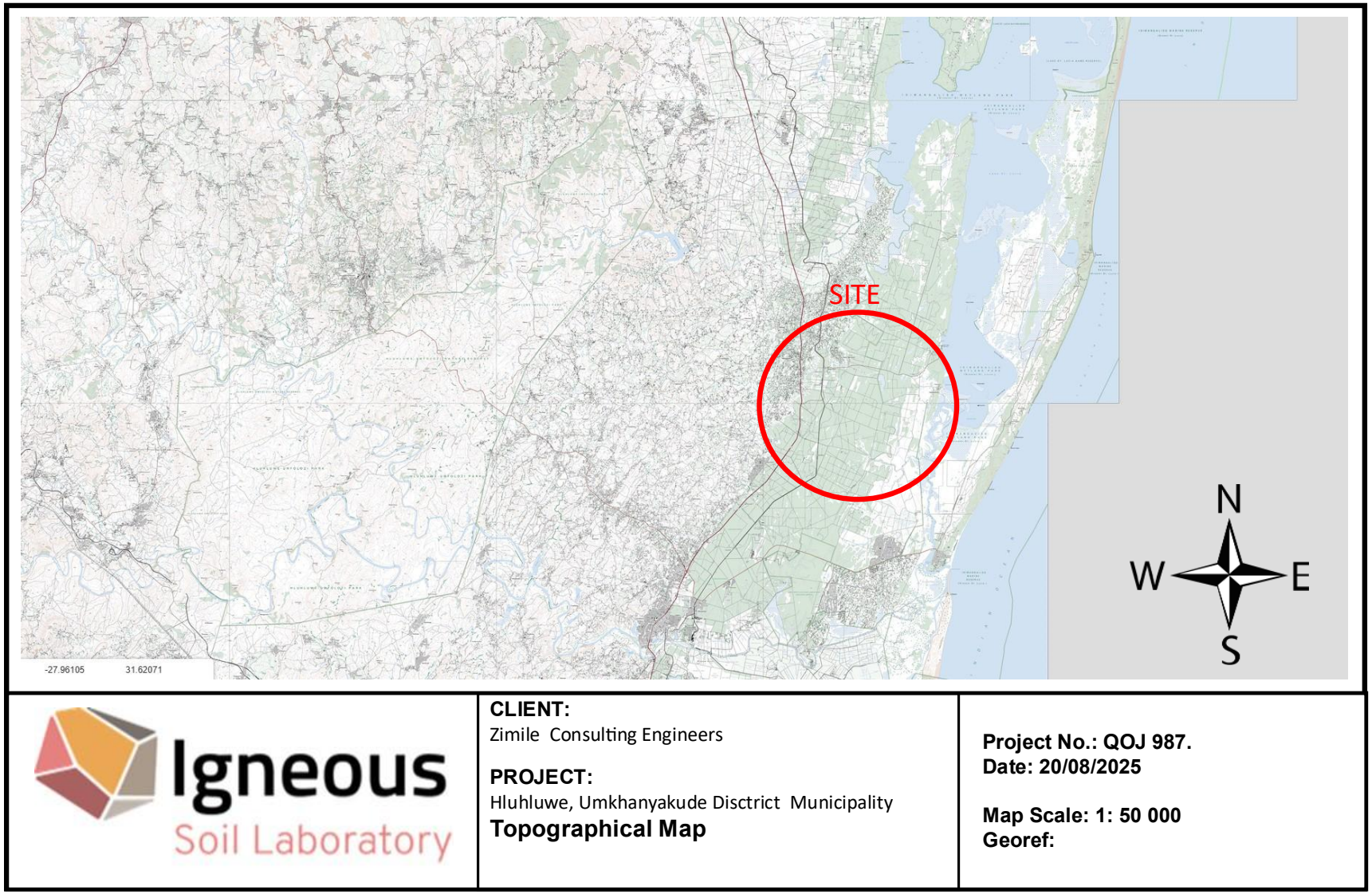


Figure 3: Topographic Map of the study area.

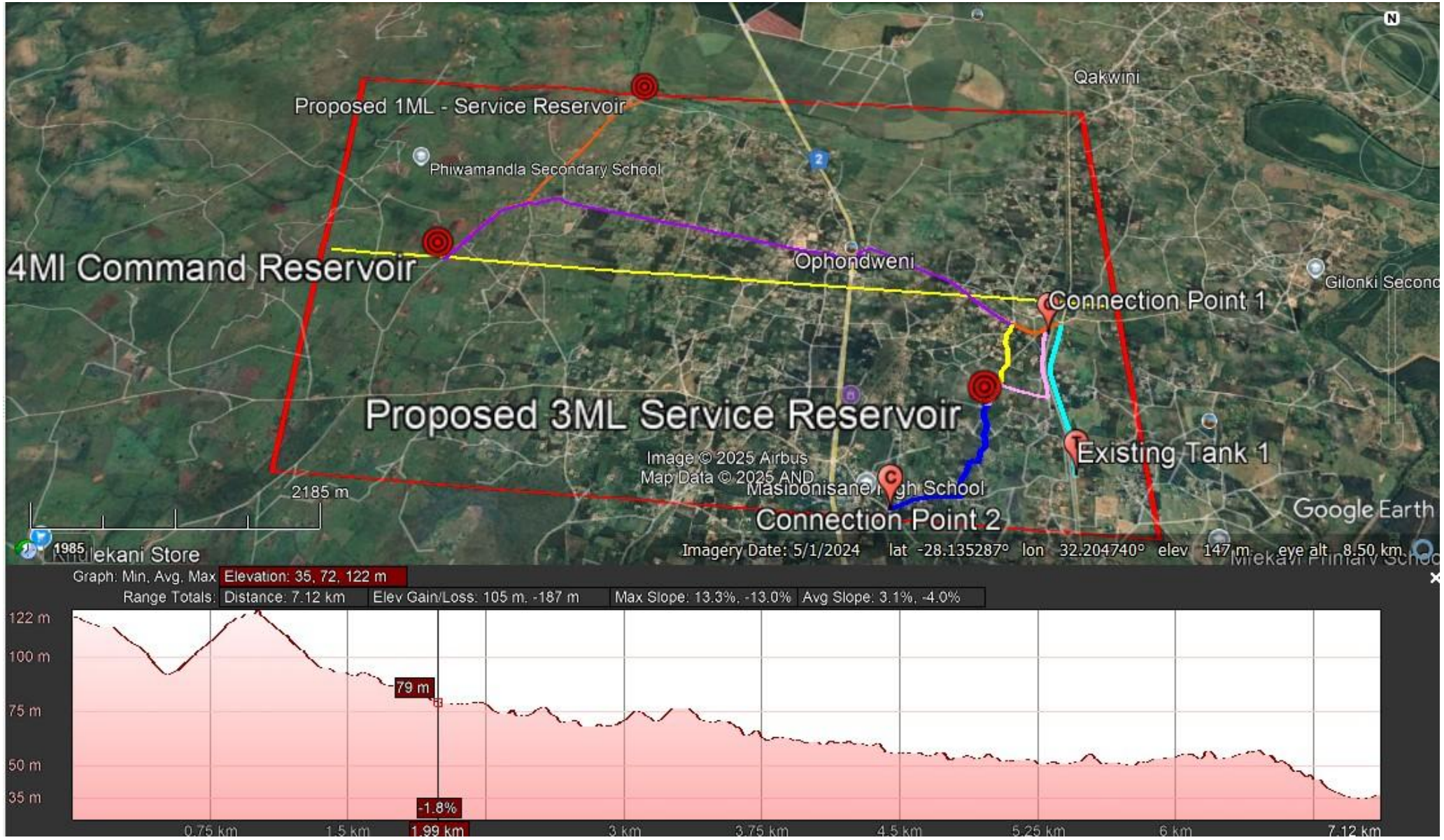


Figure 4: Elevation Profile of the study area.

3. GEOHAZARDS

3.1 Seismic Hazard/Activities

The regional seismic hazard in the study area can be defined as low, exhibiting a 10% probability of a seismic event with a peak ground acceleration that will exceed 0.05g within a period of 50 years. Figure 5 represents the probable seismic hazard of Southern Africa.

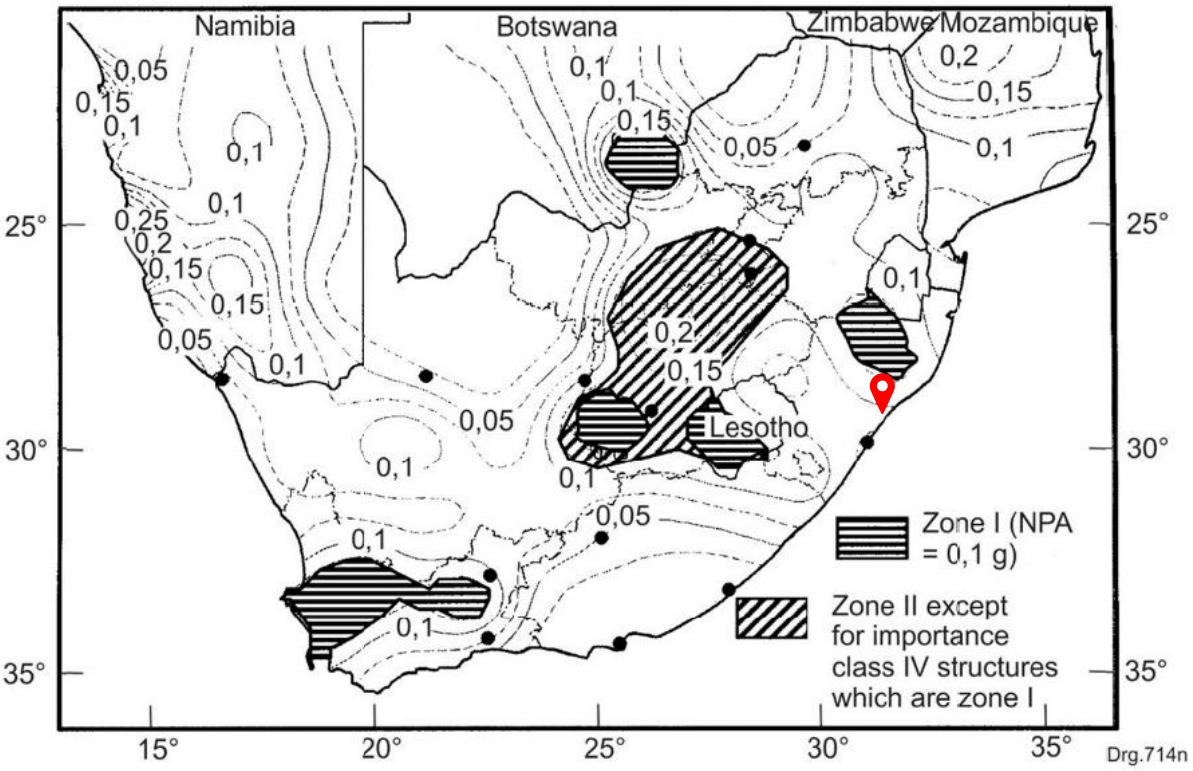


Figure 5: Seismic hazard zones of South Africa

The above map shows that Hluhluwe is a region with a potential of 0.1g peak ground acceleration indicating a moderate/medium seismic hazard level. A 10% probability exists that this value will be exceeded in a 50-year period.

3.2 Ground Subsidence

Ground subsidence refers to the gradual or sudden sinking of the natural ground due to the removal or displacement of subsurface materials. Subsidence affects the stability of structures and it must be accessed.

The common causes of subsidence are poor compaction of soil, groundwater withdrawal, mining activities and sinkholes.

The initial results of the DCP show that the site has loose to very loose material and this may cause subsidence when loaded without any soil improvements.

3.3 Erodibility of Soil

Soil erodibility refers to the susceptibility of soil to erosion, particularly by water and wind. It is influenced by soil properties such as:

- Slope: gradient of the natural ground, length and form.
- Soil geology: Soil depth, texture and topsoil.
- Vegetation/Land use: vegetation cover, rainstorm frequency and conservation practices.
- Erosion movement: rating of wind and surface run-off, sheet erosion, rill/gully/ravine erosion, mass movement.

The area of the proposed pipelines and reservoir is relatively gentle to steep, with a steep slope of 3.1% from east to west. The probability of erosion on the proposed area for extension is moderate to high. Refer to the below figure indicating low potential for erodibility index ranging between 1 – 15.

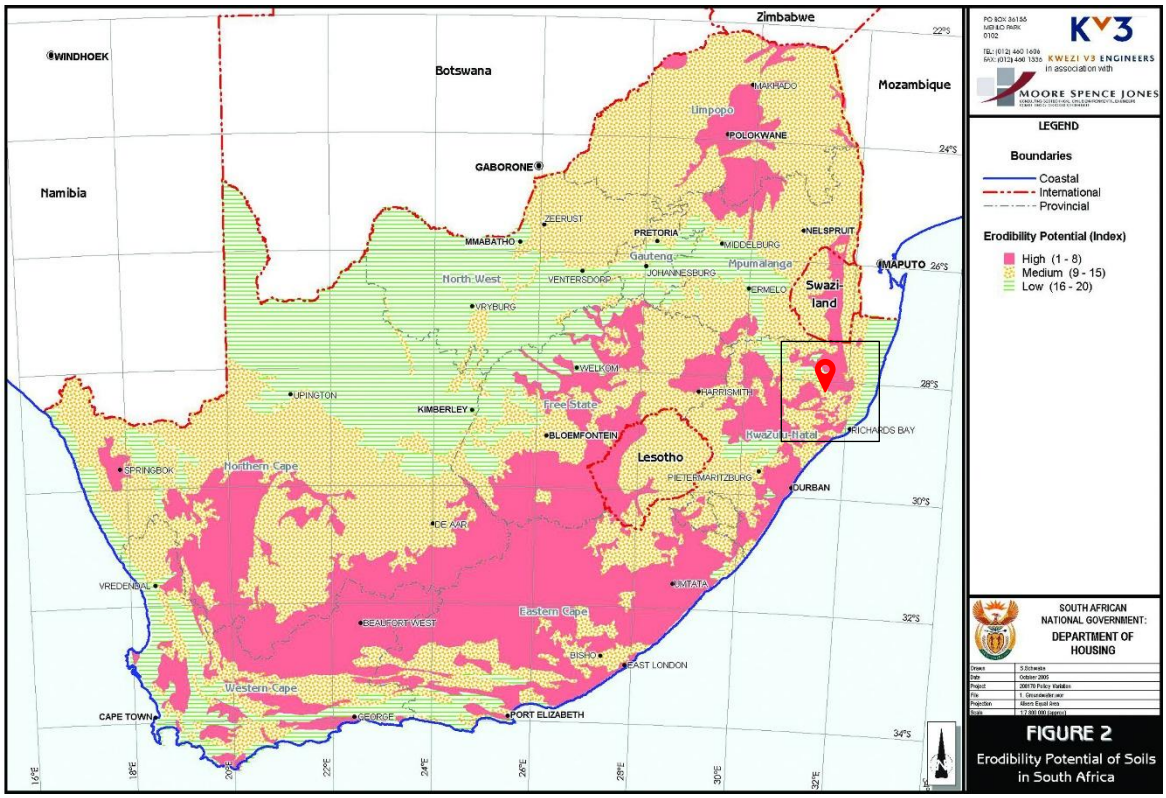


Figure 6: Erodibility potential map of South Africa

4. METHOD OF INVESTIGATION

The primary objective of the detailed investigation is to assess the soil and rock profiles across the site to provide foundation recommendations, foundation, and pipelines design parameters.

A desktop study was conducted prior to computing detailed soil investigation with results and forms basis of this report. A review of the topographical, geological, seismic hazard zones, soil erosion and groundwater maps for South Africa.

A site investigation was conducted on the 25th to 29th of August 2025 and a site Kmz file was provided by the client to have access into the area of extension and Fifty-eight (58) test pits were excavated and profiled and soil samples were taken for soil lab investigations. The investigation is based on shallow soil investigation and maximum excavation depth approximately 2 m was reached.

4.1 Desk Study

The desk study comprises of reviewing existing information for the site from existing geotechnical sources applicable to the study. These include the following:

- Topographical maps, geological maps, aerial photo interpretation - to be able to identify topographical, drainage channels and erosion features of the site.
- Geological data, such as lithology of nearby rock outcrops landforms, erosion patterns that surrounds the proposed site.
- Existing geotechnical information available of the area in the surrounds of the site.
- Data on the performance of existing engineered structures in the area.
- Data on the bodies of groundwater levels in the surrounds of the proposed site.
- Data on seismic aspects such as ground motion, liquefaction potential.

4.2 Test Pits

Fifty-five (55) test pits were excavated using a Caterpillar TLB model 428F2 with a power rating ranging from 68.5 kW to 74.5 kW. The trenches were accessed and verified not safe; the soil was profiled in accordance with the Guidelines for Soil and Rock Logging in South Africa, 2nd Impression by ABA Brink and RMH Bruin.

Soil samples were extracted for soil lab investigations to be conducted. The excavation was loosely backfilled and both side walls for the excavations were stable. The Profiles are attached on Appendix.

4.3 Dynamic Cone Penetrometer

Dynamic Cone Penetrometer were conducted adjacent to the excavated test pits.

The tests were conducted to assess the consistency of the in-situ strength of the noncohesive material from the ground surface to increased depth. The DCP results are attached on Appendix.

5. LABORATORY TESTS

Disturbed samples were taken during the onsite investigation and taken to a SANAS accredited laboratory to determine the engineering properties of the soil. The following tests are scheduled to be conducted:

- Sieve Analysis – SANS 3001: GR1, GR3
- Hydrometer Analysis – SANS 3001: GR3
- Grading Modulus – SANS 3001:
- California Bearing Ratio – SANS 3001: GR30, GR40
- Maximum Dry Density – SANS 3001: GR30, GR20
- Oedometer consolidation tests
- Triaxial consolidated undrained

5.1 Foundation Indicator Tests

Six (06) samples were extracted to conduct foundation indicator tests to classify the soil the engineering properties and provide indicators of how it behaves as a foundation material.

5.2 Compaction Tests

Thirty-two (32) samples were extracted to determine how well a soil can be compacted and how much effort is needed. The purpose of these tests was to ensure the soil is compacted to prevent future settlement and provide a stable base.

5.3 Oedometer Test

Three (03) samples were extracted to conduct the consolidation test to assess the potential settlement of a structure, especially in clayey soils.

5.4 Direct Shear Strength Test

Two samples were extracted to measure the shear strength of soil, which is its resistance to sliding along a failure plane. The purpose of the test is to determine the angle of internal friction (ϕ) and cohesion (c), key parameters in slope stability and bearing capacity.

Table 2: Laboratory testing

Test	**What It Measures**	**Purpose**	**Use**	**SANS Standard**
Foundation Indicator Tests	Plasticity, grading, MDD, OMC, CBR, linear shrinkage	General soil behaviour and foundation suitability	Site classification and pavement layers.	SANS 3001-GR1 (Grading) SANS 3001-LL1 (Liquid Limit) SANS 3001-PL1 (Plastic Limit) SANS 3001-GR30 (Linear Shrinkage) SANS 3001-GR40 (CBR)
Compaction Tests	Max Dry Density (MDD), Optimum Moisture Content (OMC), in-situ density	Ensures adequate compaction to avoid settlement and instability	Pavement layer for fills.	SANS 3001-GR30 (Proctor Test) SANS 3001-NG1 (Nuclear Density Gauge) *during construction*
Oedometer Test (Consolidation Test)	Settlement under load over time	Predicts consolidation and long-term settlement	Soft clay, pavement layers and foundations.	SANS 3001-GR10 (Consolidation using oedometer)
Direct Shear Strength Test	Shear strength: cohesion (c), angle of internal friction (ϕ)	Determines soil stability under load, slope behaviour	Pavement layers and shallow foundations	SANS 3001-GR12 (Direct Shear Test)

6. GEOLOGY

6.1 Regional Geology

According to the 1:250 000 scale 2832 St. Lucia geological map published by the Council for Geoscience; the site is underlain by the complex geological setting consisting of the older Karoo Supergroup and the younger Quaternary Sediments.

The karoo Supergroup Geology/Older deposits consist of fine-grained sandstone and siltstone, which can be weathered and friable of the Clarens formation. The overlying Drakensberg Formation is composed of basaltic lava flows, forming a more competent, though often fractured, bedrock.

The Quaternary Sediments has a lithological structure of Sandy or clayey colluvial and alluvial sediments and palaeosols, red decalcified sand in inland dune cordons, conglomerate, coquina, calcarenite, redistributed sand of the Maputaland Group a succession of late Cenozoic littoral marine deposits and is in close proximity with Fossiliferous glauconitic siltstone and fine-grained sandstone, conglomeratic towards the base of the St. Lucia .

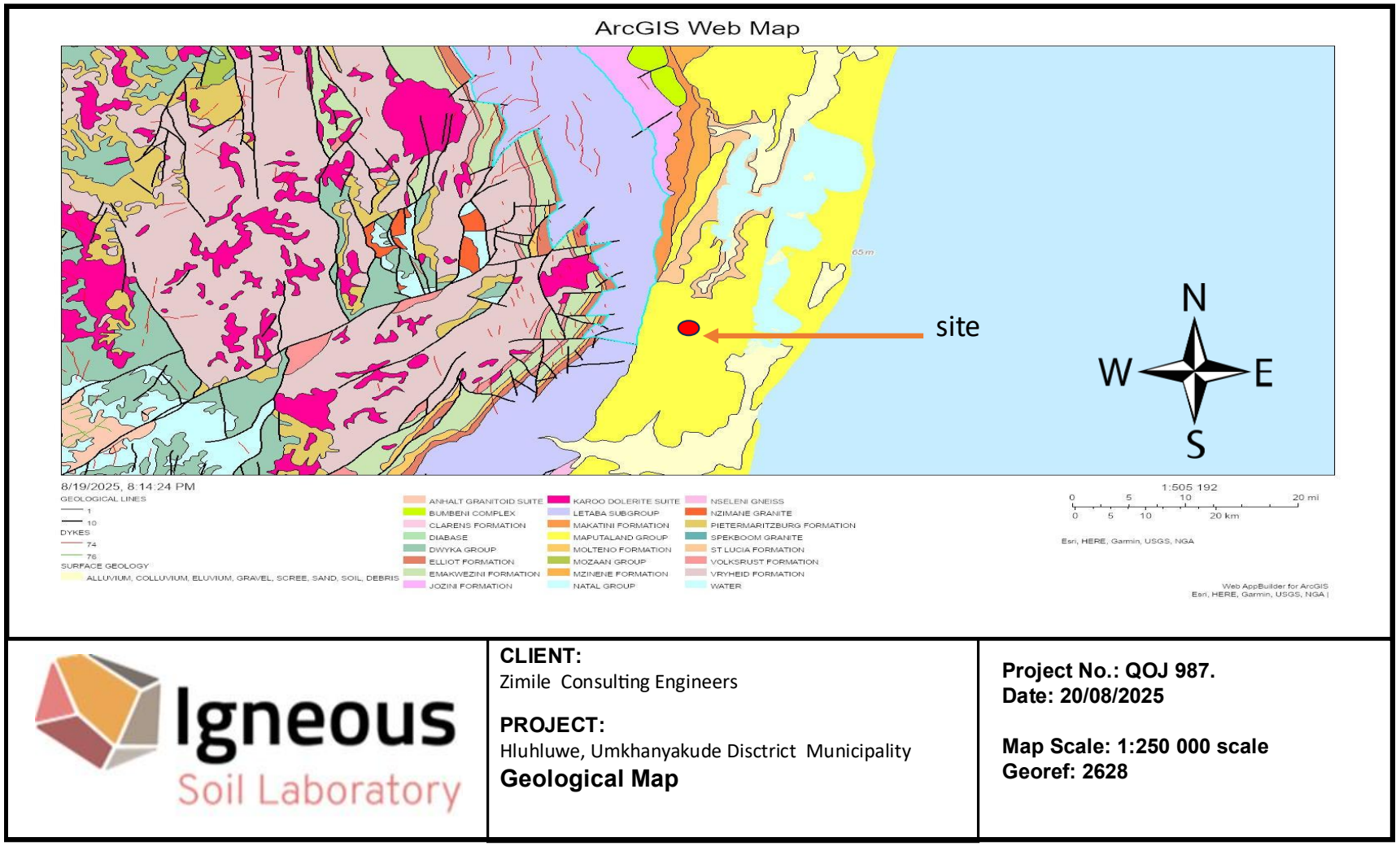
The formation, group and sequence of these sedimentary rocks is listed in Table 2. The expected engineering properties of these soils is listed in Table 3. According to the geological map, this study area is not underlain by dolomitic bedrock and a dolomite stability investigation is therefore not required. The regional geology underlying the area is presented in Figure 7.

Table 3: Lithological units of the geology of the study area.

Symbol	Formation	Sub-Group	Group	Sequence/Supergroup
N_Qm	-	-	Maputaland	_
Kst	St. Lucia	-	-	-
TR- Fine grained Sandstone	Clarrens	-	-	Karoo Sequence

Table 4: Engineering property of the residual material.

Rock Type (Geology Symbol)	Sandstone, shale
Expected Soil Profiles	Clayey/silty sand or gravel; cobbles, boulders, or rubble.
Engineering Properties	Expansive clay from tillite; pervious to semi-impervious soil; high erodibility; good to excellent compaction and workability. The low bearing capacity and high compressibility



Igneous Soil Laboratory

CLIENT:
Zimile Consulting Engineers

PROJECT:
Hluhluwe, Umkhanyakude Disctrict Municipality
Geological Map

Project No.: QOJ 987.
Date: 20/08/2025

Map Scale: 1:250 000 scale
Georef: 2628

Figure 7: Geological Map of the study area.

7. LABORATORY TEST RESULTS

A total of Thirty-two (32) disturbed soil samples recovered from the test pits and considered representative of the material were subjected to foundation indicator testing and moisture / density relationship and CBR (strength). The results are attached in Appendix A and summarized in Tables below.

Table 5: Summary of Foundation indicator results, compaction characteristics and CBR results

	TP ID.	Depth (m)	Description	GM	Atterberg Limits			USCS	AASHTO	OMC (%)	MDD (kg/m3)	Max Swell (%)	CBR at Mod. AASHTO Compaction Effort				COTO
					LL (%)	PI (%)	LS (%)						90%	93%	95%	98%	
300mm ND Steel Rising Main	TP01	0.5-2.5	Dusky Red, Inorganic SILT	0.41	44	16	8	ML	A-7-6	23.4	1633	0.15	2	3	4	5	<G9
	TP03	0.9-2.7	Dusky Red, Inorganic CLAY	0.55	41	19	9.5	CL	A-7-6	23.3	1637	0.26	1	2	2	3	<G9
	TP04	0.7-2.4	Light Yellow, Inorganic SILT	0.48	41	13	6.5	ML	A-7-6	17.2	1663	0.13	1	1	1	1	<G9
	TP05	0.2-3.0	Light Red, Clayey SAND	1.27	29	9	4.5	SC	A-2-4	11.2	1894	0.07	1	1	1	2	<G9

	TP ID.	Depth (m)	Description	GM	Atterberg Limits			USCS	AASHTO	OMC (%)	MDD (kg/m3)	Max Swell (%)	CBR at Mod. AASHTO Compaction Effort				COTO
					LL (%)	PI (%)	LS (%)						90%	93%	95%	98%	
	TP09	0.9-2.7	Reddish Brown Clayey GRAVEL	2.30	37	12	6	GC	A-2-6	15.3	1830	0.13	4	5	7	11	<G9
	TP07	1.3-3.0	Reddish Orange Clayey SAND	1.79	33	8	4	SC	A-2-4	13.4	1852	0.05	4	6	9	13	<G9
355mm ND Gravity Main	TP01	0.7-2.4	Dark Reddish Brown Poorly graded silty SAND	1.12	0	NP	0	SP/SM	A-2-7	11.3	1930	0	5	7	10	15	G9
	TP03	2.7-3.0	Dusky Red Inorganic CLAY	0.43	43	20	10	CL	A-7-6	23.3	1633	0.17	3	5	6	9	<G9
	TP09	0.7-2.1	Dark Brown Poorly graded silty SAND	1.03	0	NP	0	SP/SM	A-2-4	10.4	1777	0	3	4	6	9	<G9
	TP10	0.8-2.4	Dark Red Poorly graded silty SAND	0.96	0	NP	0	SP/SM	A-2-4	9.3	1950	0	5	8	11	17	G9
	TP13	1.0-2.6	Light Brown Poorly graded silty SAND	1.05	0	NP	0	SP/SM	A-2-7	11.4	1797	0	4	6	7	11	<G9
	TP15	1.8-2.7	Dark Brown Poorly graded silty SAND	1.03	0	NP	0	SP/SM	A-2-4	10.4	1966	0	4	6	8	12	<G9

	TP ID.	Depth (m)	Description	GM	Atterberg Limits			USCS	AASHTO	OMC (%)	MDD (kg/m3)	Max Swell (%)	CBR at Mod. AASHTO Compaction Effort				COTO
					LL (%)	PI (%)	LS (%)						90%	93%	95%	98%	
	TP17	2.0-2.3	Light Brown Poorly graded silty SAND	1.05	0	NP	0	SP/SM	A-2-7	14.5	1926	0	0	1	1	12	<G9
	TP19	2.5-2.7	Light Brown Poorly graded silty SAND	0.98	0	NP	0	SP/SM	A-2-7	9.3	1739	0	3	5	7	10	<G9
	TP20	0.0-1.9	Light Brown Poorly graded silty SAND		0	NP	0	SP/SM	A-2-7	14.5	1926	0	0	1	1	12	<G9
	TP04	0.7-2.4	Light Yellow Inorganic SILT	0.77	46	13	6.5	ML	A-7-5	17.3	1703	0.13	1	1	1	2	<G9
200mm ND Reticulation	TP05	2.3-3.0	Dark Brown Poorly graded silty SAND	0.97	0	NP	0	SP/SM	A-2-7	9.3	1880	0	4	7	9	13	G9
	TP03	2.0-3.0	Light Brown Inorganic CLAY	0.28	0	NP	0	CL	A-4	11.3	1921	0	4	6	8	13	<G9
	TP01	2.5-3.0	Dark Brown Poorly graded silty SAND	0.97	0	NP	0	SP/SM	A-2-7	8.3	1916	0	5	7	9	13	G9
90m mND	TP01	2.3-3.0	Dark Yellow. Orange Silty SAND	0.87	0	NP	0	SP/SM	A-2-7	8.3	1916	0	5	7	9	13	G9

	TP ID.	Depth (m)	Description	GM	Atterberg Limits			USCS	AASHTO	OMC (%)	MDD (kg/m3)	Max Swell (%)	CBR at Mod. AASHTO Compaction Effort				COTO
					LL (%)	PI (%)	LS (%)						90%	93%	95%	98%	
	TP03	0.0-2.0	Light Brown Poorly graded silty SAND	1.08	0	NP	0	SP/SM	A-2-7	8.2	1674	0	2	3	4	6	<G9
	TP05	2.3-3.0	Dark Brown Poorly graded silty SAND	0.93	0	NP	0	SP/SM	A-2-7	11.2	1899	0	4	6	8	12	<G9
200mmND Gravity	TP01	0.0-2.7	Light Olive Poorly graded silty SAND	0.95	0	NP	0	SP/SM	A-2-7	10.3	1770	0	3	4	5	8	<G9
	TP02	0.0-2.7	Light Brown Poorly graded silty SAND	0.99	0	NP	0	SP/SM	A-2-7	6.2	1681	0	3	4	6	9	<G9
315mmND Ret	TP02	0.0-3.0	Light Brown Poorly graded silty SAND	0.94	0	NP	0	SP/SM	A-2-7	9.1	1854	0	3	5	6	10	<G9
	TP01	0.0-2.9	Light Brown Poorly graded silty SAND	0.95	0	NP	0	SP/SM	A-2-7	6.2	1681	0	3	4	6	9	<G9
4ml Reserv	TP03	2.0-2.7	Dark Red Clayey GRAVEL	2.08	36	10	5	GC	A-2-4	15.2	1886	0	4	6	9	13	<G9
	TP01	0.0-3.0	Dark Red Clayey SAND	1.28	40	14	14	SC	A-6	8.3	1766	0	2	3	5	7	<G9
3ML Rese	TP01	0.0-2.4	Light Brown Poorly graded silty SAND	0.96	0	NP	0	SP/SM	A-2-7	10.4	1801	0	2	3	4	6	<G9

	TP ID.	Depth (m)	Description	GM	Atterberg Limits			USCS	AASHTO	OMC (%)	MDD (kg/m3)	Max Swell (%)	CBR at Mod. AASHTO Compaction Effort				COTO
					LL (%)	PI (%)	LS (%)						90%	93%	95%	98%	
	TP02	0.0-2.4	Light Brown Poorly graded silty SAND	0.95	0	NP	0	SP/SM	A-2-7	7.6	1769	0	3	4	6	9	<G9
1ML Reservoir	TP01	0.9-2.0	Dark Reddish Brown Clayey GRAVEL	2.15	40	13	6.5	GC	A-2-6	18.3	1784	0.13	3	5	7	11	<G9

***Notes**: OMC = Optimum Moisture Content; MDD = Maximum Dry Density; CBR = California Bearing Ratio; Mod = Modified; AASHTO = American Association of State Highway Officials; COLTO = Committee of Land Transportation Officials.*

7.1. Discussion of the soil Classification.

The Geotechnical data reveals a heterogeneous mix of soil types across the project, ranging from highly plastic fine-grained soils to non-plastic, well-graded coarse-grained materials. The classifications, based on the Unified Soil Classification System (USCS) and the AASHTO Classification System, highlight the variable engineering properties of the excavated material.

7.1.1. Fine-Grained Soils (Poor Subgrade)

This group is characterized by high plasticity and is primarily found in the upper soil layers across various trench sections. It classifies as **A-2-4 (SM/SC)** and **A-1-b (SM(d)** according to the AASHTO Classification System, which rates as excellent to good quality for use as subgrade layers.

Table 6: Summary of Fine grinned soil

USCS	AASHTO	Description	Key Properties	Engineering Implication
CL	A-7-6 / A-4	Inorganic CLAY	High Plasticity Index (**PI up to 20%**); High Liquid Limit (**LL up to 43%**); High Optimum Moisture Content (**OMC 23%**).	**Poor** subgrade material. High volume change potential (Max Swell up to 0.26%). **Very low CBR values** (1-3% at 98%). Generally **unsuitable** for construction fill or road layers.
ML	A-7-6 / A-7-5	Inorganic SILT	Moderate PI (13-16%); High LL (41-46%).	**Poor to Fair** subgrade material. Low CBR values (1-5% at 98%). Also classified as **<G9** (inferior to minimum required specification for fill).

7.1.2. Coarse-Grained Soils (Good to Fair Subgrade)

These materials are generally non-plastic or have low plasticity and dominate the deeper sections and reservoir areas.

Table 7: Summary of Coarse-Grained soil

USCS	AASHTO	Description	Key Properties	Engineering Implication
SP/SM	A-2-7 / A-2-4	Poorly graded silty SAND	**Non-Plastic (NP)**; Low OMC (8.2% to 14.5%); High Maximum Dry	**Good** quality fill material. Shows the **highest CBR values** in the dataset (up to 17% at 98%). Several samples (e.g., TP01 & TP10 from 355mm Gravity) achieve the target **G9**

			Density (**MDD up to 1966 kg/m³**).	classification, making them suitable for structural backfill or sub-base layers.
GC	A-2-6 / A-2-4	Clayey GRAVEL	Low to Moderate Plasticity (PI 10-13%); High GM (2.08 to 2.30).	**Good** subgrade/fill material. High CBR values (11-13% at 98%). Although classified as **<G9**, its properties suggest it can perform well as selected fill material.
SC	A-2-4 / A-6	Clayey SAND	Low Plasticity (PI 8-14%).	**Fair to Good** subgrade material. Lower CBR values (2-13% at 98%) compared to GC and SP/SM, but generally better than the fine-grained soils

7.2. The oedometer test

Three (03) samples were submitted and conducted oedometer testing.

The oedometer test is a laboratory procedure used to measure the one-dimensional consolidation properties of a soil sample. Consolidation is the process by which soil volume decreases over time under an applied load, due to the expulsion of water from the soil pores. This process is particularly important in fine-grained soils, such as clays and silts, and has a significant effect on long-term settlement of structures founded on such soils. The oedometer tests were conducted in accordance with the following standards; BS 1377 Part 5 and TMH 6 ST10.

Table 8: Summary of oedometer potential results

TP No.	Depth(m)	Material Type	Moisture content	Initial Dry Density (kg/m3)	Initial Void Ratio	Coefficient of volume Compressibility (kPa-1) Δσ150kPa	Interpretation
TP01-1ML	0.9-2.0	Residual Sandstone	5.2	1647	0.614	0.308-0.025	**Low to Moderate Initial Compressibility**. Although not negligible, this is the lowest initial compressibility.
TP01-3ML	0.0—2.9	Residual sandstone	14.6	1641	0.669	0.489-0.098	**Moderate Compressibility.** This material will experience significant, but manageable, settlement.
TP03-4ML	2.0-2.7	Residual Basalt	20.6	1194	1.317	5.257-0.129	**Extremely High Compressibility.** This value indicates the soil will undergo a massive volume reduction (settlement) under even low initial pressure (such as the weight of a structure or embankment).

The primary engineering risk is clearly associated with the TP03-4ML Residual Basalt due to its extremely high initial void ratio (1.317) and compressibility (5.257 kpa^{-1}). Foundation design must ensure that loads either avoid this material or that the material is remediated/stabilized before construction. The TP01-1ML material is the most suitable natural bearing layer.

7.3. The Consolidated undrained Triaxial test

Table 9: Summary of CU Triaxial test Results

TP No.	Depth(m)	Effective Angle of Internal Friction (Ø')	Effective Cohesion (c')	Initial Void Ratio (e_0)	Moisture Content (Initial)	Coef. of Volume Comp. (m_v) at 100 kPa	Failure Behavior (Strain)
TP01-1ML	0.9-2.0	35.9°	5.0 kPa	0.619	5.2%	(0.144 m^2/MN	**Low to High Ductility @ 10.6%**
TP01-3ML	0.0—2.9	31.2°	11.8 kPa	0.650	14%	0.880 m^2/MN	**High Ductility @ 15.4%**
TP03-4ML	2.0-2.7	30.5°	13.0 kPa	0.798	20.6%	0.632 m^2/MN	**Moderate Ductility @ 11.3%**

7.3.1. Shear Strength

The materials vary from a highly frictional, low-cohesion soil to a moderately frictional, cohesive soil. **1ML-TP01 (0.9-2.0m):** This layer exhibits the highest effective angle of internal friction (Ø'=35.9°), indicating a strong, dense, and predominantly granular/frictional material. This provides excellent long-term stability and high ultimate strength.

4ML-TP03 (2.0-2.7m): This material is the **most cohesive** (*C'=13.0 kPa*) , but has the lowest friction angle (Ø'=30.5°). Its strength relies more on inter-particle bonds, which can be sensitive to moisture changes.

3-ML-TP01 (0-2.9m): This material shows an intermediate strength profile with a moderate (Ø'=31.2°), and significant cohesion (*C'=11.8 kPa*).

7.3.2. Compressibility and Density

The initial state of the soil has a direct impact on its consolidation behaviour:

- **Initial Void Ratio : The 4ML-TP03** sample has a substantially higher average initial void ratio (0.789) compared to both TP01 samples (0.619) and (0.650) , correlating with its highest initial moisture content (20.6%). This indicates a looser structure.
- **Compressibility (m_v): The 3ML-TP01 (0-2.9m)** material shows the highest coefficient of volume compressibility (0.880 m^2/MN at 100 kPa), indicating it is the **most compressible** layer under load, which would lead to the largest settlement. The TP01 (0.9-2.0m) layer is the stiffest and least compressible (0.144 m^2/MN).

7.3.3. Shear Behaviour

All samples exhibited a tendency to generate **positive pore pressure** upon shearing (as seen in the shear stage results at failure being positive), which is typical of contractive, normally consolidated, or highly remoulded soils.

The **3ML-TP01 (0-2.9m)** sample showed the highest average strain at failure (15.4%), suggesting it is the **most ductile** and would deform significantly before failing. In contrast, **1ML-TP01 (0.9-2.0m)** showed the most brittle behaviour in its first specimen (2.3% strain) but became more ductile at higher confining stress (up to 20.2% strain).

8. GEOTECHNICAL RECOMMENDATIONS

The following recommendations are critical to ensuring the stability, serviceability, and watertightness of the reservoir structures.

8.1. Foundation Preparation and Bearing

8.1.1. Reservoirs

- 1ML and 4Ml Reservoirs

Strip and remove all unsuitable materials—specifically the soft, organic topsoil (A-horizon), loose colluvium, and the poor quality G9 or <G9 material to the competent, undisturbed Residual Granite layer.

The minimum required depth of this removal is **1.5 times** the width of the final reservoir foundation, whichever depth is greater, to effectively mitigate the highly compressible zone beneath the structures.

The exposed competent subgrade must be ripped and recompacted to a minimum of 1766kg/m^3 MDD to achieve the necessary bearing capacity and stiffness. This rip and recompact should extend up to 150 mm.

Based on the site findings (loose to very loose compressible soil, poor quality G9/<G9 subgrade) and the need to support reservoir loads, the primary design goal is to create a rigid, non-settling platform.

Here are two detailed engineering options for the platform or mattress design;

Table 10: The Engineered Soil Raft

Design Detail	**Justification & Performance**
Excavation/Cut	Remove all unsuitable material (G9/<G9) down to the competent **Residual Granite** layer or to a minimum depth of **1.5 times the width of the foundation** (to mitigate the compressible zone).
Platform Material	**G5 or G7 Selected Granular Fill** (Imported).
Compaction	Compact the fill in thin layers(150mm) to **98% Modified AASHTO (MDD)** density to establish a stable base and settlement preventation.

Thickness	Typically, **500 mm to 1,000 mm** (0.5m to 1.0m) to create a stiff, engineered mat.
Allowable Bearing Capacity	Approximately **150 kPa to 200 kPa**.

Table 11: Chemically Stabilized Soil Raft

Design Detail	**Justification & Performance**
Excavation/Cut	Remove topsoil up to 600 mm. The bulk of the **in-situ subgrade is retained** but improved.
Platform Material	**In-situ G6/G7 soil** chemically stabilized with **Cement or Lime** to achieve a **C4 or C3 specification** .
Stabilization	The stabilizer is mixed with the soil to achieve a minimum Unconfined Compressive Strength (**UCS**) after 7 days.
Thickness	**300 mm to 500 mm** thick layer of treated material.
Allowable Bearing Capacity	Approximately **200 kPa to 300 kPa**.

8.2. Seepage and Watertightness

To minimize seepage and internal erosion (piping), especially if the reservoirs are earth embankment structures, a low-permeability clay core or cut-off trench must be constructed beneath the entire reservoir structure, keyed into a low-permeability natural layer (or weathered bedrock). Permeability tests are highly recommended to confirm the suitability of the soil as core material.

8.3. Pipelines

The following recommendations apply to all pipeline segments listed (rising main, gravity mains, and reticulation mains) under the assumption that the encountered shallow soil conditions are consistent along these routes.

8.3.1. Excavation and Trench Stability

- Due to the presence of **silty sand** and **inorganic silt** (which are cohesionless or low-cohesion materials when dry and prone to collapse when wet), all excavations deeper than 1.2m must be safely battered back or mechanically supported (shoring/trench boxes) to prevent collapse and ensure worker safety, complying with relevant occupational health and safety regulations.
- If groundwater is encountered, a suitable dewatering system must be implemented immediately to maintain a dry working environment. Excavation into water-bearing silty sand or silt will result in a rapid loss of stability and potential boiling of the trench base.
- Any soft, wet, or unsuitable material identified at the trench floor must be removed (over-excavated) and replaced with selected imported granular fill , compacted to specifications.

8.3.2. Pipe Bedding and Surround

- **Subgrade:** The trench bottom must be trimmed to a uniform, firm surface, free of loose material, large stones, or organic matter. Proof rolling/compaction of the subgrade is recommended prior to bedding placement.
- **Primary Bedding:** The native silty materials are generally unsuitable for primary pipe bedding due to potential compressibility. Imported, **well-graded granular material** (such as a crusher dust or G8/G7 quality fill) must be used.
    - The bedding layer should be placed to the required thickness (typically 100mm to 150mm beneath the pipe barrel) and compacted to at least 95% of the Standard Proctor Density (SPD).
- **Side Support & Haunching:** Granular material must be placed and carefully compacted in thin layers around the haunches and up to 300mm above the pipe crown to provide uniform side support and prevent pipe deformation. Hand compaction or light mechanical compaction is required to avoid damaging the pipe.

8.3.3. Backfilling and Compaction

- **Selected Layer:** From the pipe surround to the required subgrade depth (typically 300mm below finished ground level), suitable excavated material may be

reused, provided it is free of organics, stones larger than 75mm, and is placed and compacted in thin layers (maximum 150mm loose depth).

- **Compaction Specification:** The backfill material must be compacted to achieve the target density. Based on the material , the field density must meet or exceed 95% of the reported **MDD of 1673 kg/m3** at an in-situ moisture content close to the **OMC of 17.4%**.
- **General Backfill:** The remaining trench fill to finished ground level must be compacted to a minimum of 90% of SPD. Compaction in layers is non-negotiable to prevent future differential settlement of the ground surface.

8.4. SLOPING SITES

On sloping sites steeper than 1:4 where landslip is not a consideration, the site shall be cut or backfilled (or both). The backfill will comprise of G7 or better material in-order to achieve good compaction. Compact the in-situ subgrade prior to back fill in layers not greater than150mm thickness, to 93% Mod AASHO density, at -1% to +2% of optimum moisture content. The density can be verified by means of Nuclear density tester / Dynamic Cone Penetration test.

For erosion control, the backfill must be extended to at-least 1 m beyond the footprint of the structure and has a side slope not steeper than 1:1 with respect to the horizontal, and the slope of the fill is covered with a lightly compacted material, 90% Mod AASHTO density at -1% to +2% of optimum moisture content.

For final platform finishes, the external slope should be reduced to 1:2 in-order for the gradient to encourage drainage of stormwater and garden irrigation water to drain away from the structure.

The site may be terraced in conjunction with the requirements stipulated above in-order to reduce the extent of the excavation or fill, provided that at the change of elevation, the ground behind any step is adequately drained and the steps waterproof.

The subsurface drains that might be required to prevent the passage of moisture into the interior of the building footprint shall be designed by a competent Structural Engineer.

8.5. MATERIAL USAGE

Typically, G7 quality materials are used in the upper selected layer, G8 and G9 in the lower selected layer, while G10 quality material is reserved for use in earthworks. These materials could be considered at best as special fill or should not be used as general fill where material is predominantly clayey. **"G5/G7"** could be suitable for use as a subbase layer. According to the Unified Soil Classification System, these materials generally have fair to good compaction characteristics with very low to negligible compressibility when compacted.

The soils on site are generally classified as materials of **<G9** quality according to the COLTO classification.

8.6. EARTHWORKS

Foundations should be constructed on a competent horizon. Where platforms are required, inert material (at least G7) should be used as compacted backfill provided the material complies with SANS requirements.

Any uncontrolled fill is deemed unsuitable to carry loads and should be removed during site clearing and initial earthworks. The material should be replaced with inert material compacted in layers at optimum moisture content to the underside of foundations and surface beds.

Any constructed embankments exceeding 1.5m, or as deemed necessary by the design engineers, must be stabilized by means of retaining walls. Embankments should be adequately compacted and protected from erosion.

Old, backfilled excavations (such as geotechnical test pitting) are likely to be encountered across the site and these should be cleaned out of all loose material and backfilled with appropriate gravel to densities not less than 95% mod AASHTO.

8.7. CONSTRUCTION MONITORING

8.7.1. Excavation Inspection

It is recommended that all excavations be regularly inspected by a competent Geotechnical Engineer to confirm competent founding depths and to ensure side wall stability.

8.7.2. Control Testing

Regular checks should be made on both the quality and compaction of the material used in the fill layer works to ensure that the design requirements are met.

8.8. PRECAUTIONARY MEASURES

Precautionary measures for the area should include:

- Extensive site drainage and plumbing/service precautions.
- Cut off drains and subsoil drains at strategic locations should shallow perched water table be encountered during construction.
- Damp proofing.
- The site must be graded to prevent ponding of storm water.
- 1.0m - 1.5m apron around the structures to prevent water ingress under the immediate area or the foundation.
- Planting of grass/lawn on the stands may be considered to prevent erosion.
- Care must be taken with foundation designs where foundations straddle different soil mediums such as dense and loose soil horizons.

9. CONCLUSIONS

The report is based on point data (selected positions) collected during the fieldwork phase. This data was interpolated across the study area. For this reason, site conditions may vary (for better or worse) from those presented in this report. Trenches and excavations should therefore be overseen by a competent Engineer to identify and assess any variance in the geotechnical characteristics exposed in these trenches and provide final approval.

The report has detailed the investigation conducted to assess the geotechnical characteristics of the site at Hluhluwe. Most of the site is considered developable with the exception of the areas that lie within possible flood lines. A competent Hydrologist should be appointed to delineate the flood lines areas.

All construction excavations must adhere to the most recent edition of the Occupational Health and Safety Act. A flood line analysis was not included in this investigation. Should flood line determination be necessary, a qualified professional must be contracted, and all construction activities must comply with the National Water Act.

10. REFERENCES

1. COTO: Standard Specifications for Road and Bridge Works for State Road Authorities (2022)
2. TRH 14, “Guidelines for Road Construction Materials” – NITRR, 1985
3. Department of Public Works (2007) Identification of Problematic Soils in Southern Africa.
4. Identification of problematic soils in Southern Africa – Technical notes for Civil and Structural Engineers PW2006/1. June 2007.
5. Geotechnical site investigations for housing developments. Project Linked Greenfield Subsidy Project Developments: Generic Specification GFSH-2. September 2002.
6. Brink A.B.A. and Bruin R.M.H. Guidelines for Soil and Rock Logging in South Africa, 2nd Impression 2002, Proceedings, Geoterminology Workshop organised by AEG, SAICE and SAIEG. 1990.
7. Jennings, J.E., Brink A.B.A and Williams A.A.B. Revised guide to soil profiling for civil engineering purposes in Southern Africa.1973.

C4.3 ENVIRONMENTAL

The Contractor will be responsible for environmental control on site during construction and the maintenance period. The construction activities will be monitored by an independent environmental specialist (Environmental Control Officer) and will be subject to environmental audits with reference to the Environmental Specification and Environmental Management Programme (EMPr) applicable to the contract.

The Contractor shall be required to rectify all non-conformances with the Environmental Specification and/or Environmental Management Programme (EMPr), as reported by the ECO via the environmental audit reports or by the Employer's Agent Representative in a timely manner. Failure to rectify non-conformances in a timely manner may attract sanctions as set out in this tender document and as determined by statutory authority and regulation.

LOCALITY PLAN

