



A DIVISION OF TRANSNET LIMITED

GENERAL DRAWING STANDARDS

PL 103

REV. 05

APPROVAL

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1. INTRODUCTION

The objective of this General Drawing Standards Document is to establish a set of approved drawing standards and codes of practise that shall be required to be adhered to by both Contractor and Client in the preparation of Engineering Documentation for and on behalf of Transnet Pipelines, a Division of Transnet Ltd. By ensuring comprehensive, consistent and uniform means of presentation of information, these Standards and Codes of Practise are intended to facilitate rapid comprehension by the users of the information, and thus assist in the maintenance and fault finding of installed technology.

2. SCOPE

2.1 General

This document defines as a minimum, the general responsibilities for the provision of all Engineering Documentation, whether it be by the Client or Contractor, for and on behalf of Transnet Pipelines. In this regard, providers of Engineering Documentation are required to familiarise themselves with all applicable Standards and Codes of Practise listed herein, and to ensure compliance in the execution of any work in terms of this document. Failure to comply may render the provider liable for corrections at his own cost.

These Standards and Codes of Practise should be read in conjunction with all other Specifications and drawings as issued for a particular contract. Where discrepancies occur, these must be brought to the attention of Transnet Pipelines in writing before commencement of work. In the event of any conflict between the contents of any documents forming part of a contract (as listed in the Schedule of Contract Documents) and this document, the former shall prevail.

2.2 Application to Work Activities

The Standards and Codes of Practise contained herein are suitable for use whenever Engineering Documentation is required to be produced and includes amongst others the following:

- Design Sketches
- Technical Papers and literature
- Equipment Identification and Tagging
- Construction Drawings
- Specifications, both Functional and Technical
- Installation, operating and maintenance instructions, drawings and records

3. REFERENCE DOCUMENTATION

The following standard specifications are to be used for reference purposes and need to be noted by Tenderers in order to signify familiarity and compliance with the requirements. It is expected of Tenderers that they be familiar with the applicable clauses and that these will be adhered to in the execution of any work in terms of this specification.

- a) Standards and Recommended Practices for Instrumentation and Control, 11th Edition, Instrument Society of America.

ANSI/ISA-S5.1-2009	Instrument Symbols and Identification
ISA-S5.3-1983	Graphic Symbols for DCS/Shared Display Instrumentation, Logic & Computer Systems
ISA-S5.4-1991	Instrument Loop Diagrams
ANSI/ISA-S5.5-1985	Graphic Symbols for Process Displays

- b) Graphical Symbols for Electrical Diagrams NRS 002-2000 second edition

- c) International Electrotechnical Commission Standards for Electrical Drawings

IEC Publication 27	Letter Symbols to be used in Electrical Technology
IEC Publication 50	International Electrotechnical Vocabulary
IEC Publication 617	Graphical Symbols for Diagrams

- d) SABS 0111/1990 Code of Practice for Engineering Drawings

- | | | |
|----|--------------------|------------------------|
| e) | TPL-TECH-I-POL-001 | Measurement Policy |
| f) | TPL-TECH-I-POL-002 | Control Policy |
| g) | TPL-TECH-I-POL-003 | Instrumentation Policy |

- h) American Society of Mechanical Engineers

ASME Y32.11.	Graphical Symbols for Process Flow Diagrams
ASME Z32.2.3.	Graphical Symbols for Pipe Fittings, Valves & Piping

4. ABBREVIATIONS

For the purpose of understanding these Standards, the following abbreviations apply .

ANSI	American National Standards Institute
C & I	Control and Instrumentation
IEC	International Electrotechnical Commission
ISA	Instrument Society of America
SABS	South African Bureau of Standards

5. GENERAL DRAWING STANDARDS

This specification details general drawing standards to be adhered to in the production of Engineering Documentation for and on behalf of Transnet Pipelines.

5.1 Units and Language

- 5.1.1 All drawings shall conform to SI (System International) units.
- 5.1.2 All notes, comments and text shall be in the English language.

5.2 Sizes

- 5.2.1 All drawings shall be supplied on standard sized media as listed in Table 1 below :

Table 1. Sizes of Drawing Sheets (SABS 0111-1990 Table 1).

DESIGNATION	TRIMMED SIZE (mm)	WIDTH OF BORDER (mm)
A0	841 X 1189	20
A1	594 X 841	20
A2	420 X 594	15
A3	297 X 420	15
A4	210 X 297	15

- 5.2.2 Media exceeding A0 length may be used only where absolutely necessary e.g. Long sections / pipe profiles etc, but with prior approval from Transnet Pipelines.
- 5.2.3 Where possible, the following drawing sizes shall be adhered to in the production of Engineering Documentation. Where undecided, the smallest of the recommended sizes that is consistent with clarity should be used where ever possible. Deviations from the under mentioned drawing sizes shall require prior approval from Transnet Pipelines.

DOCUMENTATION TYPE	DRAWING SIZE
--------------------	--------------

Process Drawings

Piping & Instrumentation Diagrams	A1
Process Flow Diagrams	A1
Hazardous Area Classification Diagrams	A1

Metering & Instrumentation

Instrument Schedules	A4
Instrument Data Sheets	A4
Instrument Hookup Diagrams	A4
Instrument Location Diagrams	A1
Loop Drawings	A4
Panel GA / Layout Diagrams – Internal & External	A1
Panel Wiring Diagrams	A1/A4
Cable Schedules	A1/A4
Cable Block Diagrams	A1
Cable Interconnection Diagrams	A1
Cable Routing Diagrams	A1

Software Documentation

Engineering Design / Functional Design Specs	A4
Plant I/O Schedules	A4
Flow Charts	A4
Software Listings	A4

Electrical Documentation

Electrical Load & Fault Calculations	A4
Single Line Diagrams	A1/A4
Panel GA / Layout Diagrams – Internal & External	A1
Electrical Schematic & Wiring Diagrams	A1
Cable Schedules	A1/A4
Cable Block Diagrams	A1
Cable Interconnection Diagrams	A1
Cable Routing Diagrams	A1
Protection settings schedule and curves	A4
Cable schedule to include – de-rating factor philosophy / calculations, cable lengths, voltdrop calculations	A2
Earthing Single line diagrams –	A1
Electrical equipment data sheets	A4
Hazardous area equipment certification	A4
Site and manifold Hazardous area classification drawings	A1
High Voltage yards structural equipment design and foundation drawings	A3

Mechanical Documentation

General Arrangement Diagrams
Isometrics

As required
As required

Civil/Site Layout Drawings

Site Layout Diagrams
Cable, Racking & Trenching Layout Diagrams
Survey Drawings
Earthing Reticulation Diagrams

A0/A1
A0/A1
A0/A1
A0/A1

5.3 Text Sizes & Corresponding Line Thicknesses

5.3.1 One of the following sets of standard text sizes and corresponding line thickness' shall be used :

Table 2. Text Size & Line Thickness (SABS 0111 1990 Table 2).

SET 1	
Text Size	Line Thickness
1.8 mm	0.18 mm
2.5 mm	0.25 mm
3.5 mm	0.35 mm
5 mm	0.5 mm
7 mm	0.7 mm
10 mm	1.0 mm

SET 2	
Text Size	Line Thickness
2.0 mm	0.2 mm
3.0 mm	0.3 mm
5.0 mm	0.5 mm
7.0 mm	0.7 mm
10.0 mm	1.0 mm
14.0 mm	1.4 mm

5.4 Line Types




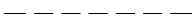



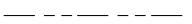
5.4.1 Mechanical Diagrams

5.4.1.1 The following line types shall be adhered to in the production of Mechanical manufacturing drawings:

Table 3. Types of Lines (SABS 0111 1990 Table 3)



GENERAL DRAWING STANDARDS

LINE	DESCRIPTION APPLICATION
A 	Visible outlines/edges
B 	Dimension, projection and leader lines cross hatching, short centre lines, imaginary lines of intersection, outlines of revolved sections
C 	Break lines
D 	Hidden features
E 	Centre lines and lines of symmetry, pitch circles, paths of motion, repeated details
F 	Cutting planes
G 	Limit of maximum or final machining
H 	Existing or adjacent parts, alternative and extreme positions of movable parts, developed views and bend lines, feature located in front of a cutting plane, portions to be removed

5.4.2 Process Diagrams

5.4.2.1 Line Types to be adhered to in the production of Process Diagrams (e.g. Piping & Instrumentation Diagrams, Flow Diagrams) are defined in Transnet Pipelines Specification PL 102 Equipment, Instrument and Electrical Symbolology Standards Document, Table 3.

5.5 Scales

5.5.1 All engineering drawings shall be produced to one of the standard scales defined below, or should the need arise, a multiple of ten thereof :

10:1	1:2	1:50	1:1000
5:1	1:5	1:100	1:2000
2:1	1:10	1:200	1:2500
1:1	1:20	1:250	1:5000

5.5.2 Conceptual drawings not drawn to scale shall be marked as "NTS" in the box provided in the title block. Plot scales shall be noted elsewhere on the drawing in these cases.

5.5.3 Where details (either enlarged or reduced), are drawn on the same sheet as the subject, the scale shall be indicated on the drawing, directly under the title of the detail.

5.5.4 Metric Reference Scale

All original drawings shall be marked with a metric reference scale at the bottom of the drawing, placed symmetrically about a centring mark near the frame of the border. The

scale shall be 100 mm in length, with a maximum width of 5 mm and marked off in units of 10 mm.

[illegible]

5.6.1 Tolerances shall be indicated on all manufacturing drawings, whether as a general note, or on specific dimensions.

5.7.1 All manufacturing drawings shall be comprehensively dimensioned and annotated, to ensure that manufacturing methods, sizes and materials etc are clear to the manufacturer.

- 5.8.1 All drawings are to bear the Transnet Pipelines title block (ANNEXURE A), with the space allocated for the drawing number left blank.
- 5.8.2 A space of either 25 mm high may be added to the top or 40 mm high may be added to the left hand side of the Transnet Pipelines title block, in which space the Contractor's details and title block may be added.
- 5.8.3 A further space of not more than 8 mm high may be added in the same area for the Contractor's drawing number.
- 5.8.4 The Contractor shall indicate the persons responsible for producing the drawing, the title, scale, project name, date, revision etc. in the spaces provided for in the Transnet Pipelines title block. (ANNEXURE A hereof)
- 5.8.5 On application, Transnet Pipelines will supply, free of charge, one "soft copy AutoCAD version" of their title block.

5.9.1	Where applicable, all reference drawings shall be noted in an appropriate place, on all drawings.
5.9.2	Smaller series drawing (A4 and A3) may bear reference drawing numbers as a note, in an appropriate position, on the drawing.



GENERAL DRAWING STANDARDS

- 5.9.3 Where a drawing is of sufficient complexity and size that warrants being split over several pages, continuation lines shall be conveyed by means of either of the under mentioned symbols. Note that the direction of the arrow shall indicate the direction of information flow.

SAMPLE TO BE USED ON P & ID
DIAGRAM ONLY

FROM HILLCREST DJP P & ID
Dwg No : 3051-001 Rev 1

OR

SAMPLE TO BE USED ON
DRAWINGS OTHER THAN
P & ID's

FROM HILLCREST DJP GA
Dwg No : 3051-001 Rev 1

5.10 Contractor's Amendment Blocks

- 5.10.1 All amendments made to existing drawings shall be indicated by the placement of the following information within a Revision Block included as part of the Drawing Border:
- | | |
|---------------------------|---|
| - Drawing Revision Number | Marked as the next consecutive alpha character. |
| - Revision Date | Date on which the amendment was made. |
| - Name | Name of Draughtsman responsible |
| - Description | Description of the amendment made. |
- 5.10.2 Revision Numbers ascribed to Engineering Design Drawings (prior to completion of a project and production of AS BUILTS) shall be placed in the Contractor's Amendment Block and shall be numbered numerically commencing with the numerals 001. AS BUILT Drawings shall be indicated by the last revision number contained in the Contractor's Amendment Block.
- 5.10.3 In order to indicate the most recent amendments made to a drawing, all amendments relating to the most recent revision number shall be highlighted by means of a "cloud" symbol placed around the modification with the Revision Number inserted within. Only the most recent amendments shall be highlighted on a drawing in this manner.

5.11 Layout

- 5.11.1 All drawings shall be laid out in a logical and legible manner and shall comply fully with all provisions as detailed in the Drawing Standards Document PL 100. Where Typical Drawing Layouts have been included in the Drawing Standards Document, Contractors shall be required to ensure compliance to such standards. Where Typical Drawing Layouts have not been defined, all proposed layouts shall be required to be approved by the nominated Transnet Pipelines representative prior to commencement of draughting work.
- 5.11.2 All orthographic projections are to be in the first angle.
- 5.11.3 Typical Drawing Layout Standards have been defined for the following documentation types and are required to be complied with in the compilation of Engineering Documentation :

(PL 100 APPENDIX B Documentation Layout Standards/Typicals)

Process Drawings

Piping & Instrumentation Diagrams
Hazardous Area Classification Diagrams

Metering & Instrumentation

Instrument Schedules
Instrument Data Sheets
Instrument Hookup Diagrams
Loop Drawings
Panel GA / Layout Diagrams – Internal & External
Cable Schedules (Refer to Electrical Typicals)



GENERAL DRAWING STANDARDS

Cable Block Diagrams (Refer to Electrical Typical)

Electrical Documentation

Single Line Diagrams
 Electrical Schematic Diagrams
 Panel GA / Layout Diagrams – Internal & External
 Cable Schedules
 Cable Block Diagrams

Mechanical Documentation

General Arrangement Diagrams

Civil/Site Layout & Survey Documentation

Trenching and Services Site Layout Diagrams
 Earthing Reticulation Diagrams
 Cable Routing Reticulation Diagrams

5.12 Symbology

5.12.1 **Process Diagrams, Metering and Instrument Drawings**

All Process Diagram and Metering & Instrument Diagram symbols shall comply with those stipulated in the Equipment, Instrument and Electrical Symbology Standards Document PL 102 Tables 1 to 10. Symbols defined in this Standard cover production of the following Document types:

Process Drawings

Piping & Instrumentation Diagrams
 Process Flow Diagrams

Metering & Instrumentation

Instrument Schedules
 Instrument Data Sheets
 Instrument Hookup Diagrams
 Instrument Location Diagrams
 Loop Drawings
 Panel GA / Layout Diagrams – Internal & External
 Panel Wiring Diagrams
 Cable Schedules
 Cable Block Diagrams
 Cable Interconnection Diagrams
 Cable Routing Diagrams

Software Documentation

Engineering Design / Functional Design Specs
 Plant I/O Schedules
 Flow Charts
 Software Listings

Graphical instrument/equipment symbols have been based on compliance with ISA Standards 11th Edition Vol 1. Standards and Recommended Practices for Instrumentation



GENERAL DRAWING STANDARDS

and Control, and American Society of Mechanical Engineers Standards ASA 732.117 and 232.2.3.

5.12.2 Manufacturing / Machining Drawings

5.12.2.1 Machining Symbols / Roughness Values

5.12.2.1.1 Machining and surface finish symbols and roughness values shall comply with the Code of Practice for Engineering Drawing SABS 0111/1990 as amended.

5.12.2.2 Welding Symbols

5.12.2.2.1 All welding symbols used shall comply with the Code of Practice for Welding, SABS 044 parts I and II, as amended.

5.12.3 Electrical Drawings

5.12.3.1 All cable and wire sizes, values of resistance, breaking capacity of switches and ratings of equipment shall be clearly specified on a drawing.

5.12.3.2 Electrical Symbols

All Electrical Diagram symbols shall comply with those stipulated in the Equipment, Instrument and Electrical Symbolology Standards Document PL 102 Section 5. Symbols defined in this Standard covers production of the following Document types :

Electrical Documentation

Single Line Diagrams
Panel GA / Layout Diagrams – Internal & External
Electrical Schematic & Wiring Diagrams
Cable Schedules
Cable Block Diagrams
Cable Interconnection Diagrams
Cable Routing Diagrams

5.12.3.3 Graphical Symbols for Electrical Diagrams NRS 002-2000 second edition

5.12.4 Other Drawings

5.12.4.1 All other drawings using symbols, must state the standard used, or else have a key as to the meaning of such symbols.

5.13 Drawing Layer Control

5.13.1 The following Layer structures shall be utilised by the Contractor in the provision of all Engineering Design Drawings. All Layer Descriptors shall comprise of alphanumeric characters and shall be descriptive in nature.

5.13.2 Process Diagrams

All Process Diagrams shall comply with the following Layer structure :

0	General
ALCOHOL	Alcohol Manifold Piping
AUX	Auxiliary Manifold Piping



GENERAL DRAWING STANDARDS

BORDER	Border
CDRAIN	Closed Drain System
CDRAINHID	Closed Drain System - below ground
DEFPOINTS	
DIESEL	Diesel Manifold Piping
EFFLUENT	Effluent System
FIRE	Fire System
FUTURE	Future Equipment, Piping
INSTR-ATTR	Instrument Attributes
INSTR-LINE	Instrument Piping
MAIN	Main Manifold Piping
NEW	
ODRAIN	Open Drain System
ODRAINHID	Open Drain System - below ground
PETROL	Petrol Manifold Piping
PIPE-ATTR	Pipe Attributes
TEXT	
TITLE	Title Block
ULP	Unleaded Manifold Piping

Layers defined in this Standard cover production of the following Document types :

Process Drawings

Piping & Instrumentation Diagrams
 Process Flow Diagrams
 Hazardous Area Classification Diagrams

5.13.3 Metering & Instrumentation Diagrams

All Metering & Instrumentation Diagrams shall comply with the following Layer structure :

0	General
BORDER	Border
DEFPOINTS	
DIM	Dimensions
FUTURE	Future Installations
INSTR-ATTR	Instrument Attributes
INSTR-LINE	Instrument Piping
NEW	
PROCESS	Process Connections
PNEU	Pneumatics
TEXT	
TITLE	Title Block

Layers defined in this Standard cover production of the following Document types:

Metering & Instrumentation

Instrument Schedules
 Instrument Data Sheets
 Instrument Hookup Diagrams
 Instrument Location Diagrams
 Loop Drawings
 Panel GA / Layout Diagrams – Internal & External



GENERAL DRAWING STANDARDS

Panel Wiring Diagrams
Cable Schedules
Cable Block Diagrams
Cable Interconnection Diagrams
Cable Routing Diagrams

5.13.4 Electrical Switchgear Diagrams

All Electrical Diagrams shall comply with the following Layer structure :

0	General
BORDER	Border
C1	Control Circuitry 1
C2	Control Circuitry 2
C3	Control Circuitry 3
C4	Control Circuitry 4
DEFPOINTS	
ELEC-ATTR	Electrical Attributes
FUTURE	Future Installations
MAIN	
NEW	
T1	Power Circuitry 1
T2	Power Circuitry 2
T3	Power Circuitry 3
T4	Power Circuitry 4
TEXT	
TITLE	Title Block

Layers defined in this Standard cover production of the following Document types :

Electrical Documentation

Single Line Diagrams
Panel GA / Layout Diagrams – Internal & External
Electrical Schematic & Wiring Diagrams
Cable Schedules
Cable Block Diagrams
Cable Interconnection Diagrams
Cable Routing Diagrams

5.13.5 Mechanical Diagrams, Manifold Piping and General Arrangements

All Mechanical Diagrams shall comply with the following Layer structure :

0	General
BORDER	Border
CDRAIN	Closed Drain System
CDRAINHID	Closed Drain System - below ground
DEFPOINTS	
DIMENSION	Dimensions
FUTURE	Future Equipment, Piping
HIDDEN	



GENERAL DRAWING STANDARDS

MAIN	
NEW	
ODRAIN	Open Drain System
ODRAINHID	Open Drain System - below ground
PLINTH	Plinth Details
PIPE-ATTR	Pipe Attributes
TEXT	
TITLE	Title Block

Layers defined in this Standard cover production of the following Document types :

Mechanical Documentation

General Arrangement Diagrams
Isometrics

5.13.6 Civil / Site Layout Diagrams

All Civil/Site Layout Diagrams shall comply with the following Layer structure:

0	General
AUX	Auxiliary Manifold Piping
BORDER	Border
BUND	Bund
BUNDW	Bund Wall
CABLE	Cable Reticulation
CDRAIN	Closed Drain System
CDRAINHID	Closed Drain System - below ground
DEFPOINTS	
DRAIN	Drainage
EARTH	Earthing System
EFFLUENT	Effluent System
FENCE	Fencing
FIRE	Fire System
FUTURE	Future Equipment, Piping
INSTR-ATTR	Instrument Attributes
INSTR-LINE	Instrument Piping
MAIN	Main Manifold Piping
NEW	
ODRAIN	Open Drain System
ODRAINHID	Open Drain System - below ground
PIPE-ATTR	Pipe Attributes
RACK	Racking Reticulation
TEXT	
TITLE	Title Block
TRENCH	Trenching Reticulation
ZONE0	Hazardous Area Classification Zone 0
ZONE1	Hazardous Area Classification Zone 1
ZONE2	Hazardous Area Classification Zone 2

Layers defined in this Standard cover production of the following Document types:

Civil/Site Layout Drawings

Site Layout Diagrams

GENERAL DRAWING STANDARDS

Cable, Racking & Trenching Layout Diagrams
Cable Routing Reticulation Diagrams
Earthing Reticulation Diagrams

5.14 Scope of Supply

5.14.1 PRESENTATION

- 5.14.1.1 All documentation shall be professionally reproduced and bound to the satisfaction of the nominated Transnet Pipelines representative. At least one set of documentation shall be marked as a "MASTER" set, and shall be presented in electronic medium suitable for reproduction. All binders and binding methods used, shall be approved by Transnet Pipelines prior to the documentation being bound.

5.14.2 SUPPLY REQUIREMENTS

Unless stipulated elsewhere in a Contract Document, the Contractor shall be required to provide the following Documentation:

5.14.2.1 **Engineering Design Documentation (Prior to construction)**

The Contractor shall be required to prepare and submit to the Engineer three prints of each working drawing/design specification for approval. One print/copy of each drawing/specification shall be returned to the Contractor once approved. Notwithstanding any approval of design or working drawings by Transnet Pipelines or a nominated representative, the responsibility for the correct functioning of the system shall rest entirely with the Contractor.

As a minimum, the following documentation is required to be approved by Transnet Pipelines prior to commencement of construction activities:

Process Drawings

Piping & Instrumentation Diagrams
Process Flow Diagrams
Hazardous Area Classification Diagrams

Metering & Instrumentation

Instrument Schedules
Instrument Data Sheets (if different from Transnet Pipelines standard Data Sheets)
Instrument Hookup Diagrams (if different from Transnet Pipelines standard Hookups)
Loop Drawings (if different from Transnet Pipelines standard Loop Drawings)
Panel GA / Layout Diagrams – Internal & External
Panel 220V/24V Power Distribution and Barrier Layout schedules
Control System Architecture Diagrams
Communication Architecture & Interconnection Diagrams
Instrument Junction Box Layout Diagrams
Cable Block Diagrams

Software Documentation

Engineering Design Specification (Software Functional Design Specification)
Plant I/O Schedules



GENERAL DRAWING STANDARDS

Flow Charts

Electrical Documentation

Electrical Load & Fault Calculations
Single Line Diagrams
Panel GA / Layout Diagrams – Internal & External
Electrical Schematic & Wiring Diagrams
Cable Block Diagrams

Mechanical Documentation

General Arrangement Diagrams
Isometrics

Civil/Site Layout & Survey Documentation

Site Layout Diagrams
Cable, Racking & Trenching Layout Diagrams
Earthing Reticulation Diagrams

5.14.2.2 Final Contract Documentation

Unless stipulated elsewhere in a Contract Document, the Contractor shall provide as a minimum the following Final Contract Documentation:

5.14.2.2.1 Maintenance and Operating Literature

Maintenance and Operating Literature is deemed to form an integral part of all equipment supplied and shall require to be supplied along with all equipment installed on Transnet Pipelines sites. Supply shall include comprehensive data on servicing, faultfinding, repairs, procedures and full particulars with diagrams of how the equipment functions. All technical literature, calculations and drawings, which will enable Engineering Staff to be fully informed on electrical, control and mechanical aspects, shall be included.

5.14.2.2.2 AS BUILT Documentation

Process Drawings

Piping & Instrumentation Diagrams
Process Flow Diagrams
Hazardous Area Classification Diagrams

Metering & Instrumentation

Instrument Schedules
Instrument Data Sheets
Instrument Hookup Diagrams
Instrument Location Diagrams
Loop Drawings
Panel GA / Layout Diagrams – Internal & External
Panel Wiring Diagrams
Panel 220V/24V Power Distribution and Barrier Layout schedules
Control System Architecture Diagrams
Communication Architecture & Interconnection Diagrams
Instrument Junction Box Layout Diagrams
Cable Schedules

GENERAL DRAWING STANDARDS

Cable Block Diagrams
Cable Interconnection Diagrams
Cable Routing Diagrams

Software Documentation

Engineering Design Specification (Software Functional Design Specification)
Plant I/O Schedules
Flow Charts
Detail Software Listings

Electrical Documentation

Electrical Load & Fault Calculations
Single Line Diagrams
Panel GA / Layout Diagrams – Internal & External
Electrical Schematic & Wiring Diagrams
Cable Schedules
Cable Block Diagrams
Cable Interconnection Diagrams
Cable Routing Diagrams
Protection settings schedule and curves.
Cable schedule to include – de-rating factor philosophy / calculations, cable lengths, volt drop calculations.
Earthing Single line diagrams.
Electrical equipment data sheets.
Hazardous area equipment certification.
Site and manifold Hazardous area classification drawings.
High Voltage yards structural equipment design and foundation drawings.

Mechanical Documentation

General Arrangement Diagrams
Isometrics

Civil/Site Layout & Survey Documentation

Survey Drawings
Site Layout Diagrams
Cable, Racking & Trenching Layout Diagrams
Earthing Reticulation Diagrams

5.14.2.2.3 Special Documentation

- Operators Manual/s describing the equipment, system or plant from an operational viewpoint. This shall include any special or supervisory facilities.
- Technical Manual/s which describe the overall configuration of the system, capabilities of the system, how changes are to be made to the configuration of the system and all maintenance and special procedures necessary for Transnet Pipelines to maintain the equipment installed. This manual/s shall encompass both software and hardware requirements and shall be project orientated. Drawings (ie. Wiring diagrams, dimensioned mechanical components/equipment etc.), excluding basic illustrations contained in manuals – Copies of these drawings are to be supplied separately with the “As-built” drawings and registered in the appropriate drawing index.



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- 5.14.2.3 Final Contract Documentation Copies. (See also 5.16 for specific requirements for the supply of "As-built" documentation.

Unless stipulated elsewhere in a Contract Document, the Contractor shall provide as a minimum the following number of copies of Final Contract Documentation:

- Master Control Centre – one full set in soft format (CD, DVD, Hard Drive)
- Drawing Office/Library – one MASTER set in soft format (CD, DVD, Hard Drive)
- Workshops – one full set in soft format each (CD, DVD, Hard Drive)
- Depot – one full set in soft format (CD, DVD, Hard Drive)
- Project Manager and those designated - one full set in soft format (CD, DVD, Hard Drive)

- 5.14.2.4 Before being submitted to Transnet Pipelines, all Final Contract Documentation and in particular AS BUILT Drawings shall be examined for compliance with on site detail by the Contractor and signed as such.

- 5.14.2.5 All documentation (inclusive of hard copies and software) shall be supplied with a comprehensive Indexing system, to enable ease of access to drawing files. This index shall include as a minimum, the file names, drawing title, brief description, Contractor's/consultant's name and Drawing number, pipeline name etc. Transnet Pipelines shall provide a Microsoft Excel spreadsheet with the correct headings within the appropriate columns. Where possible, indexes shall be integral to the packages used; where not possible, indexes shall be presented in a Microsoft compatible database format.

- 5.14.2.6 Final Contract Documentation shall be submitted to the Engineer within eight weeks of the Contract completion date.

5.14.3 SOFTWARE PLATFORMS.

- 5.14.3.1 The following Software Platforms are used by Transnet Pipelines and are required to be utilised by the Contractor for compilation of all Engineering Documentation as follows:

Word Processing	Microsoft Word for Microsoft Windows XP.
Spreadsheets	Microsoft Excel for Microsoft Windows XP.
Database	Microsoft Access for Microsoft Windows XP.
Draughting	AutoCAD Release 2004 or Later.
Survey	ESRI ArcGIS.

- 5.14.3.2 The following Engineering Design Documentation types are currently installed on software platforms as detailed below, within Transnet Pipelines. Contractors will be required to provide the under mentioned documentation on the same software platforms.

Process Drawings

Piping & Instrumentation Diagrams	AutoCAD
Process Flow Diagrams	AutoCAD
Hazardous Area Classification Diagrams	AutoCAD

Metering & Instrumentation

Instrument Schedules	MS Excel
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Instrument Data Sheets	MS Excel
Instrument Hook-up Diagrams	MS Excel (Embedded AutoCAD)
Instrument Location Diagrams	AutoCAD
Loop Drawings	AutoCAD
Panel GA / Layout Diagrams – Internal & External	AutoCAD
Panel Wiring Diagrams	AutoCAD
Cable Schedules	AutoCAD
Cable Block Diagrams	AutoCAD
Cable Routing Diagrams	AutoCAD
Cable Interface Wiring Diagrams	AutoCAD

Electrical Documentation

Electrical Load & Fault Calculations	MS Excel
Single Line Diagrams	AutoCAD
Panel GA / Layout Diagrams – Internal & External	AutoCAD
Electrical Schematic & Wiring Diagrams	AutoCAD
Cable Schedules	AutoCAD
Cable Block Diagrams	AutoCAD
Cable Routing Diagrams	AutoCAD
Cable Interface Wiring Diagrams	AutoCAD
Protection settings schedule and curves	MS Excel
Cable schedule to include – de-rating factor philosophy / calculations, cable lengths, voltdrop calculations	MS Excel
Earthing Single line diagrams	AutoCAD
Electrical equipment data sheets	MS Excel
Hazardous area equipment certification	AutoCAD
Site and manifold Hazardous area classification Drawings	AutoCAD
High Voltage yards structural equipment design and foundation drawings	AutoCAD

Mechanical Documentation

General Arrangement Diagrams	AutoCAD
Isometrics	AutoCAD

Civil/Site Layout Drawings

Site Layout Diagrams	AutoCAD
Cable, Racking & Trenching Layout Diagrams	AutoCAD
Earthing Reticulation Diagrams	AutoCAD

Survey Drawings/Diagrams

ESRI ArcGIS / AutoCAD

Drawing Index

Microsoft Excel

5.14.4 OWNERSHIP & COPYRIGHT

5.14.4.1 The Contractor shall be required to grant to Transnet Pipelines a non exclusive copyright, in accordance with the provisions of Section 22 of the Copyright Act 1978 :

- To copy any plan, diagram, drawing, specification, bill of quantities, design calculation, application software or similar document generated for and on behalf of Transnet Pipelines



GENERAL DRAWING STANDARDS

- To make free and unrestricted use thereof for its own purposes, modify the same or have it modified by a third party for any reason
- To provide copies thereof to a third party (contractors or consultants) of Transnet Pipelines for the purposes of Tendering or Consultancy

No separate or extra payment shall be due by Transnet Pipelines in respect of any non-exclusive licence granted in terms of this clause.

- 5.14.4.1 The Transnet Pipelines emblem included in the title block is subject to copyright law, and therefore, must in no way be altered, distributed, defaced or tampered with, or handled in any way that will be an infringement on the copyright thereof.

5.15 Alignment Sheets

5.15.1 Type

- 5.15.1.1 Aerial Photo strip type alignment sheets shall be supplied
- 5.15.1.2 A minimum of 500 m of photographed area is to be recorded on either side of the pipeline

5.15.2 Scale

- 5.15.2.1 Horizontal 1:5000
- 5.15.2.2 Vertical 1:500 (Profile / long section)

5.15.3 Media

- 5.15.3.1 Hardcopy: Paper Minimum size A2 – 2 copies.
- 5.15.3.2 Electronic: 1 copy "PDF" Format
1 Copy in AutoCAD
1 Copy in Native format. (Where applicable)
- 5.15.3.3 Paper - Bond or similar – Min 80 gsm
- 5.15.3.4 Max size - A0 (841 mm x 1189 mm)

5.15.4 Contours

- 5.15.4.1 Contours at 2 m intervals are to be marked up on the alignment sheets

5.15.5 L.O. System

- 5.15.5.1 Relevant co-ordinate grids must be marked up on all alignment sheets
- 5.15.5.2 L.O. systems used must correspond with those used on the servitude diagrams produced by the Land Survey Office.
- 5.15.5.3 L.O. systems used must be noted in the title block or on the grid lines
- 5.15.5.4 Each alignment sheet shall bear an accurately determined North indicating arrow

5.15.6 Profile (Long Section)

- 5.15.6.1 Each alignment sheet shall have a relevant land and piping profile drawn at the bottom of the sheet.

5.15.7 Boundaries

- 5.15.7.1 All boundaries are to be recorded on alignment sheets, including, cadastral and municipal boundaries, and property boundaries adjoining the pipe servitude.



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- 5.15.7.2 All farm names and numbers, lots, subs, erfs etc. are to be recorded on alignment sheets
- 5.15.8 **Crossings**
- 5.15.8.1 All crossings of existing services are to be recorded on the alignment sheets, indicating the type of service e.g. road, 22 kV overhead power lines, rivers, etc. (roads must be identified by name and/or number).
- 5.15.8.2 Existing services crossed, are to be reference coded as ES1, ES2, ES3 etc.
- 5.15.8.3 Copies of all documentation with regard, to the crossing of existing services, such as, deeds, agreements, way leaves etc, are to be bound into book form and indexed to correspond with the reference codes on the alignment sheets
- 5.15.8.4 Lengths and diameters of sleeves or culverts are to be indicated on the alignment sheets.
- 5.15.8.5 Any crossing reference drawing numbers are to be recorded in the space provided
- 5.15.9 **Markers**
- 5.15.9.1 The exact position of all route, distance, offset and street markers are to be recorded on alignment sheets
- 5.15.9.2 Route markers are to be numbered from the preceding distance marker e.g. between the origin of the pipeline and the first distance marker (km1) the route markers shall be numbered M0/1, M0/2, M0/3 etc. and between distance markers km13 and km14, the route markers shall be numbered M13/1, M13/2 etc.
- 5.15.9.3 Distance markers are to be placed so as to indicate the actual length of pipe
- 5.15.9.4 Distance markers are to be numbered sequentially from the origin, with the origin being 0 km
- 5.15.9.5 Offset markers are to be clearly marked as such, and their actual position, with relation to the centre line of the pipe, indicated.
- 5.15.10 **Pipe Protection**
- 5.15.10.1 All pipe protection measures are to be indicated on the alignment sheets (e.g. wrappings, rock shield etc.), as to the full extent of such pipe protection
- 5.15.11 **Wall Thickness**
- 5.15.11.1 The pipe wall thickness is to be marked on each alignment sheet.
- 5.15.11.2 Changes in pipe wall thickness shall be clearly and accurately marked on the alignment sheets
- 5.15.12 **Block Valves**
- 5.15.12.1 Block valves will be numbered sequentially starting with BV1.
- 5.15.13 **Cathodic Protection Equipment**
- 5.15.13.1 The position of all cathodic protection equipment shall be clearly and accurately recorded on alignment sheets (e.g. rectifiers, test points, cross bonds, cable routes, anode beds etc.)
- 5.15.13.2 Rectifiers are to be numbered sequentially as, R1, R2, R3 etc., with R1 being the closest rectifier to the origin
- 5.15.13.3 Test points are to be numbered sequentially from the block valves e.g. the test point at block valve 3 shall be numbered 3/1 and the next test point between block valves 3 and 4 shall be numbered 3/2 etc.
- 5.15.14 **General**
- 5.15.14.1 Any reference drawings shall be noted in the space allocated on the alignment sheets



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- 5.15.14.2 The type and position of all pipefittings is to be accurately recorded on the alignment sheets e.g. thread o-rings, pig signals, stopple fittings etc.
- 5.15.14.3 Any cable routes (e.g. pig signal cables etc.) are to be accurately recorded on the alignment sheets
- 5.15.14.4 Each alignment sheet shall have a key to the symbols used on it
- 5.15.14.5 All road and river names, where affected by the pipeline, are to be recorded on the alignment sheets
- 5.15.14.6 All alignment sheets shall have "cut lines" at both ends, to enable the matching up of consecutive alignment sheets
- 5.15.14.7 Key plans of the pipe route shall be supplied on 1:50 000 scale topo-cadastral maps. (transparencies)

5.16 Specific Requirements "As-Built" Documentation

5.16.1 Specific Requirements

- 5.16.2 General: All Manuals (technical, operating etc.), Standards and Specifications:
- Electronic Copy requirements:
 One Electronic copy of the "As-built"/ Final in PDF Format (must be able to print copies), plus one Electronic copy in the Native format (where applicable) in which it was produced. Both copies to be accessible (with the necessary controls) from the Electronic Document Management System provided for the specific project. e.g. SAP, Aconnex etc.

5.16.3 All Drawings and Diagrams:

Electronic Copy requirements:
 One Electronic copy of the "As-built"/Final in PDF Format (must be able to print copies), plus one Electronic copy in "AutoCAD 2004 or later" (where applicable) and one Electronic copy in the Native format in which it was produced (where applicable). All copies to be accessible (with the necessary controls) from the Electronic Document Management System provided for the specific project. e.g SAP, Aconnex etc.

5.16.4 Mechanical Engineering Documents:

Certificates, tests and data packs

The original signed document of Conformance certificates, Test certificates, Material certificates and Data packs must be supplied together with one scanned copy in PDF format.

Manuals

Any Technical, Operating, Equipment or Maintenance Manuals received from Vendors in original Hardcopy (published, not scanned) format must be supplied in that format (4 originals) together with a scanned copy in PDF Format.

Any Technical, Operating, Equipment or Maintenance Manuals received from Vendors in original electronic format (i.e. published in electronic format) must be supplied as one electronic format copy and one printed copy. (Suitably bound and referenced).

5.16.5 Electrical Engineering Documents:



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Certificates

The original signed documents of "Certificate of Compliance" and "Hazardous area equipment certification" must be supplied together with one scanned copy in PDF format.

Manuals

Any Technical, Operating, Equipment or Maintenance Manuals received from Vendors in original Hardcopy (published, not scanned) format must be supplied in that format (4 originals) together with a scanned copy in PDF Format.

Any Technical, Operating, Equipment or Maintenance Manuals received from Vendors in original electronic format (i.e. published in electronic format) must be supplied as one electronic format copy and one printed copy. (Suitably bound and referenced).

Drawings and Diagrams

In addition to 5.16.3, the following site / pump station specific documentation must be supplied (2 As-Built Hardcopy Prints).

1. Single Line Diagrams.
2. Panel GA / Layout Diagrams – Internal & External.
3. Electrical Schematic & Wiring Diagrams.
4. Cable Block Diagrams.
5. Cable Routing Diagrams.
6. Earthing Single line diagrams.
7. Site and manifold Hazardous area classification drawings.

- 5.16.6 Handover of As-Built and Other Documents from Transnet Pipelines Technical Projects to Transnet Pipelines Drawing Office must be as per **TPL-TECH-DO-SOP-001**. (See **Appendices C** for Handover of As-Built and Other Documents from Technical Projects to Drawing Office Standard Operating Procedure).

End of document

APPENDICES

A Sample Title Block