

TRANSNET PIPELINES



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DRAWING OFFICE STANDARD (PL102)

DOCUMENT APPROVAL PROCESS

NAME		POSITION/MEETING NO.	SIGNATURE	DATE
Originator:	Zandile Molo	Drawing Office Manager		20/06/2016
Approver:	Petros Khumalo	Technical Support Manager		30-06-2016
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1. INTRODUCTION

The purpose of this standard is to establish a uniform means of designating plant, equipment, instrumentation and electrical switchgear as installed on the respective pump station sites within Transnet Pipelines, on technical drawings and in documentation. By ensuring a comprehensive, consistent and uniform means of representing plant, equipment and instrumentation on technical drawings and in documentation, it is hoped that this Standard will assist in the rapid identification of equipment and instrumentation, as well as correct interpretation of information presented.

2. SCOPE

2.1. GENERAL

This document defines graphical symbology standards to be adopted when representing all plant, equipment, instrumentation and electrical switchgear on technical drawings and in documentation. Plant, equipment and instrumentation symbology has been based on the Instrument Society of America Standards ISA S5.1-1984 and ISA S5.3-2009 respectively, and supplemented to include Transnet Pipelines specific equipment. Electrical Switchgear symbology has been based on the International Electrotechnical Commission Standards IEC Publication 60617 as adopted by SABS/NRS 002-2000.

It is not the intent of these Standards to mandate the usage of each type of symbol for each occurrence of a generic device within the overall control system, which may result in undue complexity, but rather to enable the designer the facility to use internationally recognised symbology to convey the level of detail required to accurately reflect the process.

In this regard, symbology and rules of usage as defined within this Standard are required to be adhered to by Client and Contractor alike, for and on behalf of Transnet Pipelines, a Division of Transnet Ltd. Both Client and Contractor will be required to familiarise themselves with all applicable Standards and Codes of Practice 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 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.

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2.2. APPLICATION TO WORK ACTIVITIES

The Standards contained herein are suitable for use whenever plant, equipment, instrumentation or electrical switchgear are required to be represented in technical drawings and in documentation. These Standards thus cover designation of plant, equipment, instrumentation and electrical switchgear in the following types of documentation:

- Flow Diagrams, process and mechanical
- Piping and Instrumentation diagrams
- Instrumentation system diagrams
- Electrical switchgear diagrams
- Specifications, purchase orders, manifests and other lists
- Construction Drawings
- Technical Papers, literature and discussions
- Tagging of Instruments
- Installation, operation and maintenance instructions, drawings and records

3. REFERENCE DOCUMENTATION

The following standard specifications are to be used for reference purposes. 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

ANSI/ISA - S 5.2-1992 Binary Logic Diagrams for Process Operations

ANSI/ISA-S5.3-1983 Graphic Symbols for Distributed Control, Shared Display Instrumentation, Logic and Computer Systems

ANSI/ISA - S 5.5-1985 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. American Society of Mechanical Engineers (ASME)

ASME Y32.11 - 1961 Graphical Symbols for Process Flow Diagrams

ASME Y32.2.3 - 1994 Graphical Symbols for Pipe Fittings, Valves & Piping.

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4. ABBREVIATION

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
ASA	:	American Standards Association

5. EQUIPMENT & INSTRUMENT SYMBOLOGY STANDARD

Equipment / Instrument Symbols as defined in the tables contained in Appendix A conform to the following standards:

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

ANSI/ISA-S5.1-2009 Instrument Symbols and Identification

ANSI/ISA - S 5.2-1992 Binary Logic Diagrams for Process Operations

ANSI/ISA-S5.3-1983 Graphic Symbols for Distributed Control, Shared Display Instrumentation, Logic and Computer Systems

ANSI/ISA - S 5.5-1985 Graphic Symbols for Process Displays

- B. American Society of Mechanical Engineers (ASME)

ASME Y32.11 - 1961 Graphical Symbols for Process Flow Diagrams

ASME Y32.2.3 - 1994 Graphical Symbols for Pipe Fittings, Valves & Piping.

The symbol descriptions listed to the right of each symbol are intended to serve as guidelines for applicability and have been supplemented by comments where further clarity may be required.

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5.1. SYMBOL DEFINITIONS (Refer to Appendix A)

Table 1	General Instrument or Function Symbols
Table 2	Interlock and Math Functionality
Table 3	Line Symbology
Table 4	Fire System Symbology
Table 5	General Symbology
Table 6	Pump Symbology
Table 7	Valve Symbology
Table 8	Mechanical Symbology
Table 9	Equipment Symbology
Table 10	Tank Symbology

5.2. RULES FOR USAGE

5.2.1 . Individual pieces of equipment and instrumentation shall be uniquely identified on technical drawings and documentation via means of the symbols defined above. Where pieces of equipment / instrumentation have easily defined or recognisable relationships, these need not be individually tagged on a diagram. For example, an orifice plate need not be separately tagged to the differential pressure transmitter, for the purposes of flow measurement. Also, where there is a primary element connected to another instrument on a diagram, use of a symbol to represent the primary element on the diagram is optional.

5.2.2 . Where an instrument/equipment has more than one function and denotation of these are necessary to gain a full understanding of the process, these functions may be individually reflected by symbols located alongside one another and tagged separately. Use of contiguous symbols may thus be used to reflect the following additional functionality:

- Interfacing between associated instruments e.g. hardwiring, internal system links, backup.
- Instrument integrated multiple functions.

5.2.3. Brief explanatory notation may be added adjacent to the symbol or line to clarify instrument functionality e.g. a lead analyser may have the letters Pb placed adjacent to the symbol to indicate the function of the analyser; a temperature probe may have the letters PT100 placed adjacent to the symbol to indicate the element type.

5.2.4. Where math functionality is performed within an instrument (e.g. square root extraction) such functionality may be indicated by means of explanatory notation placed adjacent to the instrument symbol.

5.2.5. Orientation and sizing of symbology should be selected with neatness and legibility in mind. Function Block designation and Tag Numbers should always be drawn on the horizontal.

5.2.6. Electrical, pneumatic or other power supply to an instrument need not be shown, unless it is essential to an understanding of the function or operation of an instrument or loop.

5.2.7. The sequence in which instruments or functions are connected on a diagram should reflect the functional logic and need not necessarily correspond to the signal connection sequence. For example, an analogue instrument using voltage feedback requires parallel wiring whereas an instrument using current feedback requires series wiring, although both are represented in documentation using identical symbology.

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5.2.8. The degree of detail to be applied to each document or drawing lies entirely at the discretion of the user. For example, sketches and technical papers usually contain simplified symbology whereas P & ID Diagrams and Process Flow Diagrams may show all in-line components. In all cases, consistency should be exercised for each document /drawing type, and in this regard the reader is required to familiarise himself with examples of drawings included in the Drawing Standards Document in order to ascertain degree of detail requirements.

5.2.9. Interlocking Functionality. For the sake of clarity and in order to prevent technical drawings from becoming cluttered, only hardwired interlocking functionality need be reflected on technical drawings produced for and on behalf of Transnet Pipelines. All other interlocking functionality shall be defined in Software Documentation and Functional Design Specifications accompanying the installation of Control Systems technology.

5.2.10. Where graphical symbols are similar in nature and may cause misinterpretation, cautionary notes should be added to the document/drawing, in order to assist in interpretation.

5.2.11. Alarm and Trip Functionality. All derived tags (alarm and trip functionality) shall be represented by the placement of additional notation alongside the instrument symbol on a drawing. In this regard the following notation has been derived to date:

PAHH	Press Trip High
PAH	Press Alarm High
PALL	Press Trip Low
PAL	Press Alarm Low
dP/dT	Rate of Change
PDA	Deviation from Setpoint

6. EQUIPMENT & INSTRUMENT SYMBOLOGY STANDARD

Electrical Switchgear Symbology used shall conform to the International Electrotechnical Commission Standards IEC Publication 60617 as adopted by SABS/NRS 002-2000 (Amended 1994).

Lists of the more commonly used symbols have been included in Appendix B for reference purposes. The symbol descriptions listed to the right of each symbol are intended to serve as guidelines for applicability and have been supplemented by comments where further clarity may be required.

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7. APPENDICES APPENDIX A

Equipment & Instrument Symbol Tables

Table 1 General Instrument or Function Symbols	Table 2 Interlock and Math Functionality
 COMPUTER FUNCTION AUXILIARY LOCATION  COMPUTER FUNCTION PRIMARY LOCATION  COMPUTER FUNCTION FIELD MOUNTED  DISCRETE INSTRUMENT AUXILIARY LOCATION  DISCRETE INSTRUMENT PRIMARY LOCATION  DISCRETE INSTRUMENT FIELD MOUNTED  DIGITAL CONTROL/ MONITORING PRIMARY LOCATION  DIGITAL SIGNAL FIELD MOUNTED  DIGITAL CONTROL AUXILIARY LOCATION	 INTERLOCK  ROOT EXTRACTION  AVERAGING  PROPORTIONAL  INTEGRAL  DERIVATIVE <p>SIGNAL CONVERSION X=E - VOLTAGE X=H - HYDRAULIC X=I - CURRENT X=O - E.MAGNETIC, SONIC X=P - PNEUMAT X=R - RESISTANCE (ELECT.) X=A - ANALOG X=D - DIGITAL X=B - BINARY</p>  PURGE AIR

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Table 3
Line Symbology

	INTERNAL SYSTEM LINK
	ELECTRIC SIGNAL
	MECHANICAL LINK
	PRIMARY PROCESS LINK
	PRIMARY PROCESS LINK (UNDERGROUND)
	SECONDARY PROCESS LINK
	SECONDARY PIPING LINK (UNDERGROUND)
	UNDEFINED SIGNAL
	PNEUMATIC SIGNAL
	HYDRAULIC SIGNAL
	CAPILLARY TUBE
	ELECTROMAGNETIC SIGNAL (GUIDED)
	ELECTROMAGNETIC SIGNAL (UNGUIDED)
	PNEUMATIC BINARY SIGNAL
	ELECTRIC BINARY SIGNAL

Table 4
Fire System Symbology

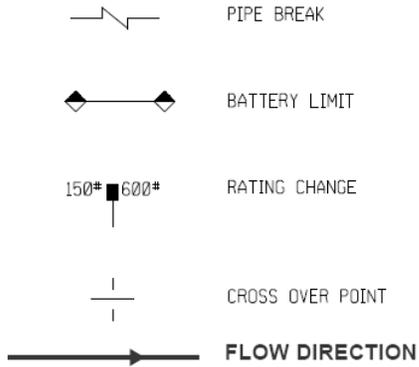
	BALL PRESSURE PROPORTIONER
	BURSTING DISK
	FIRE HYDRANT SINGLE
	FIRE HYDRANT DOUBLE
	FIRE HYDRANT QUADRUPLE
	HYDRANT FOAM
	FOAM POURER
	HIGH BACK PRESS. GENERATOR
	OSC MONITOR
	FIXED MONITOR
	SPRINKLER NOZZLE
	TANK DRENCHING NOZZLE
	FIRE LINES
	FOAM CANNON COVERAGE
	FOAM POURER COVERAGE
	FOAM SPRINKLER COVERAGE
	FOAM CANNON
	FLAME DETECTOR
	HYDROCARBON LIQUID DETECTOR
	HYDROCARBON GAS DETECTOR
	CONTROL VALVE

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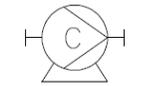


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**Table 5
General Symbology**



**Table 6
Pump Symbology**



CENTRIFUGAL PUMP



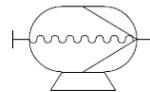
DOSING PUMP



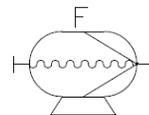
POSITIVE DISP. PUMP



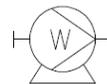
COMPRESSOR



SCREW PUMP



FOAM PUMP



WATER PUMP

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Table 7 Valve Symbology	Table 8 Mechanical Symbology
3-WAY VALVE	ACTUATOR - PNEUMATIC
4-WAY VALVE	ACTUATOR - ELECTRIC
BALL VALVE	MANUAL VALVE WITH POSITION FEEDBACK
BUTTERFLY VALVE	SAFETY END CLOSURE
CHECK VALVE	DRIP CUP
CONTROL VALVE	DRY BRAKE COUPLING
DIAPHRAGM VALVE	END CAP
EXPANDING PLUG VALVE	FLANGE BLIND
PLUG VALVE	FLANGE INSULATING
NEEDLE VALVE	FLANGE SET
GATE-PARALLEL VALVE	FLEXIBLE HOSE
GATE-WEDGE VALVE	GOOSE NECK
GLOBE VALVE	SLOP INJECTOR
PRESSURE SUSTAINING VALVE	JAIL BARS
PRESSURE RELIEF VALVE	SPECTACLE LINE BLIND - OPEN
THERMAL RELIEF VALVE	SPECTACLE LINE BLIND - CLOSED
UNSPECIFIED VALVE	SPADE LINE BLIND - OPEN
SPHERE HANDLING VALVE	SPADE LINE BLIND - CLOSED
SPHERE RELEASE FINGER	STOPPLE FITTING
	LOADING ARM
	ORIFICE PLATE
	254x203 CONCENTRIC REDUCER
	SIZE ECCENTRIC REDUCER
	EYE WASH & EMERGENCY SHOWER

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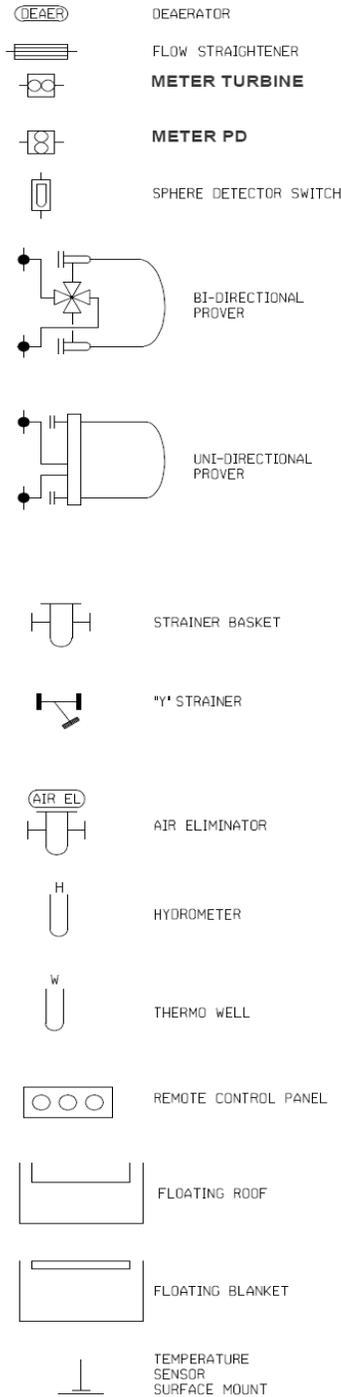
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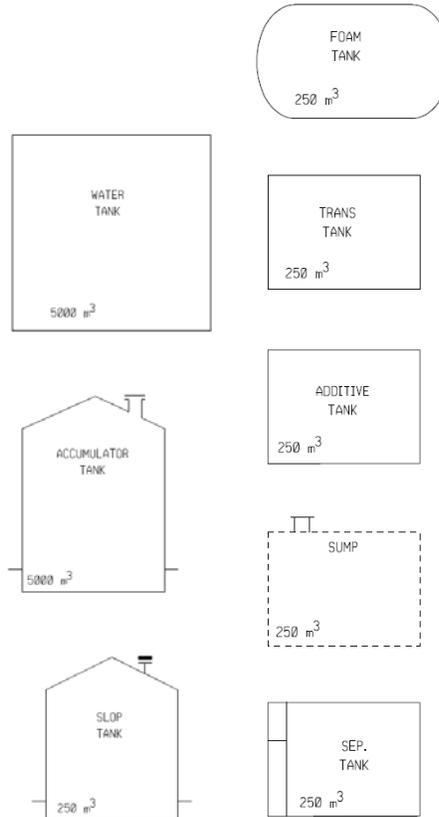
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**Table 9
Equipment Symbology**



**Table 10
Tank Symbology**

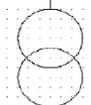


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APPENDIX B

Electrical Switchgear Symbol Tables

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

	Earth general symbol Earthing, general symbol, Ground (US) general symbol; Grounding (US) general symbol		Coil, general symbol, Winding general symbol Inductor; Choke
	Make contact, general symbol, switch, general symbol		Semiconductor diode, general symbol
	Break contact		Induction motor, three phase, squirrel cage
	Change-over break before make contact		Transformer with two windings, general symbol (form 1)
	Circuit Breaker		Rectifier
	Disconnecter, Isolator		Primary cell
	Switch-disconnector, On-load isolating switch		Lamp, general symbol lamp Signal lamp, general symbol
	Operating device, general symbol; Relay coil, general symbol Operating coil of a selector (form 1)		Direct current
	Fuse, general symbol		Alternating current
	Resistor, general symbol		
	Capacitor, general symbol		

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8. DOCUMENT CHANGE HISTORY:

The owner of this document is responsible for the revision and control of the document, including updating of the table below, which contains the history of the document with details of each revision.

Date	Previous Rev No.	New Rev No.	Details of Revision
15.01.99	00	01	Document approved for distribution.
12.06.12	01	02	New Transnet Standard Template Adopted
26.05.16	02	03	Document review and update & New Template

This table summarises what has been changed in the document so that it is easy to keep track of the effected changes.