

IDENTIFICATION OF INSTRUMENT AND FUNCTION SYMBOLS

IDENTIFIERS																									
First Letters	Initiating or Measured Variable	Controllers				Readout Devices		Switch Devices ^{SEE NOTE 3}			Alarm Devices / Conditions ^{SEE NOTE 3}				Transmitters			Solenoids, Relays, Computing Devices	Primary Element	Test Point	Well or Probe	Viewing Device, Glass	Safety Device	Final Element	
		Recording	Indicating	Blind	Self-Actuated Control Valves	Recording	Indicating	High**	Low	Comb	Low-Low	Low	High	High-High	Recording	Indicating	Blind	AY	AE						
A	Analysis	ARC	AIC	AC		AR	AI	ASH	ASL	ASHL	AALL	AAL	AAH	AAHH	ART	AIT	AT	AY	AE	AP	AW	BG			AV
B	Burner/Combustion	BRC	BIC	BC		BR	BI	BSH	BSL	BSHL	BALL	BAL	BAH	BAHH	BRT	BIT	BT	BY	BE			BW	BG		BZ
C	User's Choice																								
D	User's Choice																								
E	Voltage	ERC	EIC	EC		ER	EI	ESH	ESL	ESHL	EALL	EAL	EAH	EAHH	ERT	EIT	ET	EY	EE						EZ
F	Flow Rate	FRC	FIC	FC	FCV,FICV	FR	FI	FSH	FSL	FSHL	FALL	FAL	FAH	FAHH	FRT	FIT	FT	FY	FE	FP			FG		FV
FQ	Flow Quantity	FORC	FQIC			FQR	FQI	FQSH	FQSL		FQALL	FQAL	FOAH	FQAHH		FQIT	FQT	FQY	FQE						FQV
FF	Flow Ratio	FFRC	FFIC	FFC		FFR	FFI	FFSH	FFSL		FFALL	FFAL	FFAH	FFAHH					FE						FFV
G	User's Choice																								
H	Hand	HIC	HC					HS																	HV
I	Current	IRC	IIC			IR	II	ISH	ISL	ISHL	IALL	IAL	IAH	IAHH	IRT	IIT	IT	IY	IE						IZ
J	Power	JRC	JIC			JR	JI	JSH	JSL	JSHL	JALL	JAL	JAH	JAHH	JRT	JIT	JT	JY	JE						JV
K	Time	KRC	KIC	KC	KCV	KR	KI	KSH	KSL	KSHL	KALL	KAL	KAH	KAHH	KRT	KIT	KT	KY	KE						KV
L	Level	LRC	LIC	LC	LCV	LR	LI	LSH	LSL	LSHL	LALL	LAL	LAH	LAHH	LRT	LIT	LT	LY	LE		LW	LG			LV
M	User's Choice																								
N	User's Choice																								
O	User's Choice																								
P	Pressure/Vacuum	PRC	PIC	PC	PCV	PR	PI	PSH	PSL	PSHL	PALL	PAL	PAH	PAHH	PRT	PIT	PT	PY	PE	PP				PSV,PSE	PV
PD	Pressure, Differential	PDRC	PDIC	PDC	PDCV	PDR	PDI	PDSh	PDSL		PDALL	PDAL	PDaH	PDaHH	PDRT	PDIT	PDT	PDY	PE	PP					PDV
Q	Quantity	QRC	QIC			QR	QI	QSH	QSL	QSHL	QALL	QAL	QAH	QAHH	QRT	QIT	QT	QY	QE						QZ
R	Radiation	RRC	RIC	RC		RR	RI	RSH	RSL	RSHL	RALL	RAL	RAH	RAHH	RRT	RIT	RT	RY	RE		RW				RZ
S	Speed/Frequency	SRC	SIC	SC	SCV	SR	SI	SSH	SSL	SSHL	SALL	SAL	SAH	SAHH	SRT	SIT	ST	SY	SE						SV
T	Temperature	TRC	TIC	TC	TCV	TR	TI	TSH	TSL	TSHL	TALL	TAL	TAH	TAHH	TRT	TIT	TT	TY	TE	TP	TW		TSE		TV
TD	Temperature, Differential	TDRC	TDIC	TDC	TDCV	TDR	TDI	TDSh	TDSL		TDALL	TDAL	TDaH	TDaHH	TDRT	TDIT	TDT	TDY	TE	TP	TW				TDV
U	Multivariable					UR	UI											UY							UV
V	Vibration/Machinery Analysis					VR	VI	VSH	VSL	VSHL	VALL	VAL	VAH	VAHH	VRT	VIT	VT	VY	VE						VZ
W	Weight/Force	WRC	WIC	WC	WCV	WR	WI	WSH	WSL	WSHL	WALL	WAL	WAH	WAHH	WRT	WIT	WT	WY	WE						WZ
WD	Weight/Force, Differential	WDRC	WDIC	WDC	WDCV	WDR	WDI	WDSh	WDSL		WDALL	WDAL	WDaH	WDaHH	WDRT	WDIT	WDT	WDY	WE						WDZ
X	Unclassified																								
Y	Event/State/Presence	YIC	YC			YR	YI	YSH	YSL		YALL	YAL	YAH	YAHH			YT	YY	YE						YZ
Z	Position/Dimension	ZRC	ZIC	ZC	ZCV	ZR	ZI	ZSH	ZSL	ZSHL	ZALL	ZAL	ZAH	ZAHH	ZRT	ZIT	ZT	ZY	ZE						ZV
ZD	Gauging/Deviation	ZDRC	ZDIC	ZDC	ZDCV	ZDR	ZDI	ZDSh	ZDSL		ZDALL	ZDAL	ZDAH	ZDAHH	ZDRT	ZDIT	ZDT	ZDY	ZDE						ZDV

SYMBOLS	REMOTE LOCATION NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	AUXILIARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR	REMOTE LOCATION NORMALLY FIELD ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS				
SHARED DISPLAY & CONTROL (PLC & SCADA / HMI)				
COMPUTER FUNCTION				
PROGRAMMABLE LOGIC CONTROL (WITH NO HMI OR SCADA INTERFACE)				
INSTRUMENTS SHARING A HOUSING				
EXAMPLE				

MISCELLANEOUS AND MINOR EQUIPMENT SYMBOLS	
	INTERLOCK LOGIC (WITH OR WITHOUT INTERLOCK NUMBER)
	RESET
	PURGE OR FLUSHING DEVICE
	PILOT LIGHT (LOCALLY MOUNTED)
	PILOT LIGHT (REMOTE LOCATION)
	HEATING ELEMENT (ELECTRICAL)
	CALIBRATION VESSEL
	SILENCER
	OPEN VENT
	SPRAY NOZZLE(S)
	FILTER OR STRAINER
	PULSATION DAMPER
	LUBRICATOR
	TRAP (STEAM / OTHER)
	DIAPHRAGM SEAL
	DRAIN
	INTERFACE / RESPONSIBILITY LIMITS (IN THIS CASE BETWEEN RAND WATER AND CONTRACTOR)
	DRAWING REFERENCE
	SYSTEM / SUB-SYSTEM BOUNDARY MARKER (CONTAINS SYSTEM WKS CODE)

DRG No. A9499

NOTES

- ALL PIPING AND INSTRUMENTATION SYMBOLS AND IDENTIFICATIONS ARE BASED ON AMERICAN NATIONAL STANDARD ANSI/ISA-S5.1-1984 (R1992). FOR ADDITIONAL NOTES & SYMBOLS REFER TO THIS STANDARD.
- FOR THE PURPOSES OF WKS CODING / TAG NUMBERING OF INSTRUMENTS AND EQUIPMENT:
 - INSTRUMENT, FUNCTION AND EQUIPMENT SYMBOLS SHALL BE ACCOMPANIED BY A 2-4 DIGIT TAG NUMBER
 - FOR INSTRUMENTS AND FUNCTION SYMBOLS, THIS TAG NUMBER SHOULD APPEAR INSIDE THE BUBBLE (SEE EXAMPLE ON SHEET 1 OF 2).
 - FOR EQUIPMENT SYMBOLS, THE TAG SHOULD APPEAR AS THE 2-3 LETTER EQUIPMENT TYPE CODE FOLLOWED BY THE TAG NUMBER (FOR EXAMPLE FCV-101, TK-05, SL-03, MX-02)
 - FOR WKS CODING PURPOSES, A 3 COLUMN CROSS-REFERENCING TABLE MUST APPEAR ON OR ACCOMPANY THE P&ID DIAGRAM INDICATING TAG NUMBER, WKS CODE AND DESCRIPTION
- NOTE THAT THE TABLE OF INSTRUMENT / FUNCTION IDENTIFIERS (FAR LEFT) IS NOT ALL-INCLUSIVE; OTHER IDENTIFIER COMBINATIONS INCLUDE:

FO	RESTRICTION ORIFICE
FRK, HIK	CONTROL STATIONS
FX	ACCESSORIES
TJR	SCANNING RECORDER
LH	PILOT LIGHT
PER	RATIO
KOI	RUNNING TIME INDICATOR
QOI	INDICATING COUNTER
WKIC	RATE-OF-WEIGHT-LOSS CONTROLLER
HMS	HAND MOMENTARY SWITCH
- ADDITIONAL TO LOW-LOW, LOW, HIGH AND HIGH-HIGH SWITCHES & ALARMS, ALTERNATIVES SUCH AS OPEN (O) OR CLOSED (C), MAY BE USED (FOR EXAMPLE ZSO AND ZAC). THE LETTERS LL, L, H, OR HH MAY BE OMITTED IN THE UNDEFINED CASE.

ACTUATORS

	DIAPHRAGM - SPRING OPPOSED OR UNSPECIFIED ACTUATOR
	DIAPHRAGM - PRESSURE BALANCED
	CYLINDER - SPRING OPPOSED (SINGLE ACTING)
	CYLINDER (DOUBLE ACTING)
	MOTORISED (ROTARY)
	ELECTROHYDRAULIC
	SOLENOID
	DIGITAL
	HAND ACTUATOR OR HANDWHEEL
	FOR PRESSURE RELIEF / SAFETY VALVE (REPRESENTS SPRING / WEIGHT OR INTEGRAL PILOT)

ACTUATOR POWER FAIL MODES

PREFERRED SYMBOL	ALTERNATIVE SYMBOL	
		FAIL CLOSED
		FAIL OPEN
		FAIL INDETERMINATE
		FAIL LOCKED (LAST POSITION)
		THREE-WAY VALVE FAIL OPEN PATH INDICATED BY ARROW

SIGNALS, LINES & FITTINGS

	MAJOR PROCESS LINE
	MINOR PROCESS LINE
	ELECTRIC SIGNAL
	SOFTWARE / DATA SIGNAL
	PNEUMATIC SIGNAL
	HYDRAULIC SIGNAL
	CAPILLARY TUBING
	MECHANICAL LINK
	ELECTROMAGNETIC (GUIDED)
	ELECTROMAGNETIC (UNGUIDED)
	HEAT TRACING
	LINES CUT-OFF (INDICATIVE OF LONG LENGTH)
	CROSSING LINES
	WATER DISTRIBUTION PIPELINES
	FLANGED CONNECTION
	GENERAL JOINT
	BUTT WELD JOINT
	SCREWED JOINT
	QUICK COUPLING CONNECTION
	FLEXIBLE HOSE
	FLEXIBLE CONNECTION
	REDUCER

FUNCTION BLOCKS

	SUMMATION (ADD)	$M = X_1 + X_2 + \dots + X_n$
	AVERAGE	$M = \frac{X_1 + X_2 + \dots + X_n}{n}$
	DIFFERENCE (SUBTRACT)	$M = X_1 - X_2$
	PROPORTIONAL	$M = K \cdot X$
	REVERSE PROPORTIONAL	$M = -K \cdot X$
	RATIO	$M = \frac{(X_1)}{(X_2)} \cdot X$
	INTEGRAL	$M = \frac{1}{T_i} \int X dt$
	DERIVATIVE	$M = T_D \cdot \frac{d(X)}{dt}$
	MULTIPLY	$M = X_1 \cdot X_2$
	DIVIDE	$M = \frac{X_1}{X_2}$
	ROOT EXTRACTION	$M = \sqrt[n]{X}$
	EXPONENTIAL	$M = X^n$
	NONLINEAR / UNSPECIFIED FUNCTION	$M = f(x)$
	TIME FUNCTION	$M = f(t)$
	HIGH SELECTING (H)	$M = \begin{matrix} X_1 & \text{if } X_1 \geq X_2 \\ X_2 & \text{if } X_1 < X_2 \end{matrix}$
	LOW SELECTING (L)	$M = \begin{matrix} X_1 & \text{if } X_1 \leq X_2 \\ X_2 & \text{if } X_1 > X_2 \end{matrix}$
	HIGH LIMITING (H)	$M = \begin{matrix} X & \text{if } X \leq H \\ H & \text{if } X > H \end{matrix}$
	LOW LIMITING (L)	$M = \begin{matrix} X & \text{if } X \geq L \\ L & \text{if } X < L \end{matrix}$
	VELOCITY LIMITING (H)	$\frac{d(X)}{dt} = \begin{matrix} \frac{d(X)}{dt} & \text{if } \frac{d(X)}{dt} \leq H \\ H & \text{if } \frac{d(X)}{dt} > H \end{matrix}$
	BIAS	$M = X \pm b$
	SIGNAL CONVERSION	SIGNAL INPUT (IN) AND OUTPUT (OUT) TYPES: E = VOLTAGE I = CURRENT P = PNEUMATIC A = ANALOG B = BINARY H = HYDRAULIC Q = ELECTROMAGNETIC R = RESISTANCE (ELECTRICAL) D = DIGITAL M = MECHANICAL

VALVES

	GATE OR UNSPECIFIED VALVE
	ANGLE VALVE
	THREE-WAY VALVE
	FOUR-WAY VALVE
	GLOBE VALVE
	BUTTERFLY VALVE
	PLUG VALVE
	THREE-WAY PLUG VALVE
	BALL VALVE
	THREE-WAY BALL VALVE
	DIAPHRAGM VALVE
	CHECK (NON-RETURN) VALVE
	DAMPER OR LOUVER
NO	VALVE IS NORMALLY OPEN (BELOW VALVE)
NC	VALVE IS NORMALLY CLOSED (BELOW VALVE)

SUPPLY ABBREVIATIONS

IAS	INSTRUMENT AIR SUPPLY
NS	NITROGEN SUPPLY
WS	WATER SUPPLY
HS	HYDRAULIC SUPPLY
SS	STEAM SUPPLY
GS	GAS SUPPLY
ES	ELECTRIC SUPPLY

SPECIFICATION INDICATOR

DN150-PN16-PVC	MATERIAL OF CONSTRUCTION
	NOMINAL PRESSURE (RATING) (bar)
	NOMINAL DIAMETER (SIZE) (mm)

FLOW MEASUREMENT & DEVICES

	ORIFICE PLATE AND DP-CELL FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	VENTURI TUBE AND DP-CELL FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	FLOW NOZZLE AND DP-CELL FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	MAGNETIC FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	ULTRASONIC FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	CORIOLIS FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	VORTEX FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	ROTAMETER / VARIABLE AREA FLOW METER (LOCAL INDICATION ONLY)
	PROPELLER OR TURBINE FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	TARGET FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	AVERAGING PITOT TUBE FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	FLUME FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	WIER FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	UNCLASSIFIED FLOW METER / TRANSMITTER (WITH LOCAL INDICATION)
	POSITIVE DISPLACEMENT TYPE FLOW TOTALISING INDICATOR
	FLOW SITE GLASS (PLAIN OR WITH PADDLE WHEEL)
	RESTRICTION ORIFICE

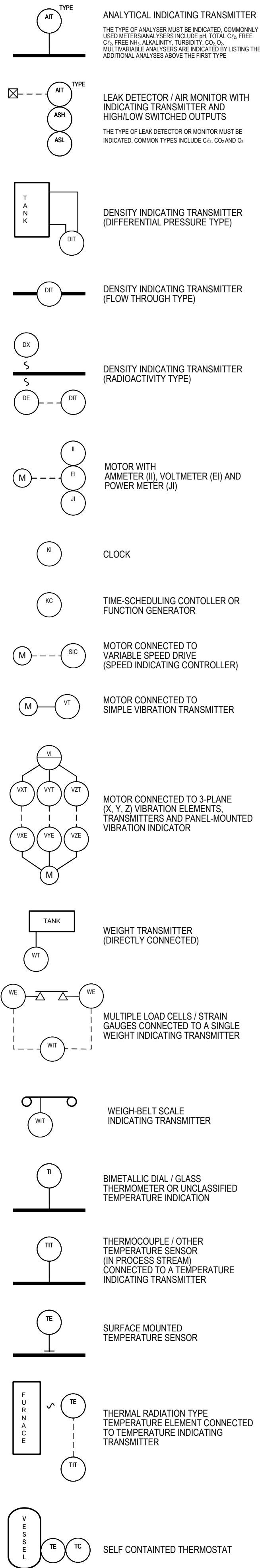
PRESSURE MEASUREMENT & DEVICES

	PRESSURE GAUGE
	PRESSURE INDICATING TRANSMITTER
	PRESSURE INDICATING TRANSMITTER WITH DIAPHRAGM / CHEMICAL SEAL
	PRESSURE GAUGE AND PRESSURE TRANSMITTER ON COMMON MANIFOLD (WITH DIAPHRAGM / CHEMICAL SEAL)
	SELF-CONTAINED PRESSURE REDUCING REGULATOR WITH HANDWHEEL ADJUSTABLE SETPOINT
	SELF-CONTAINED BACK-PRESSURE REGULATOR
	PRESSURE REDUCING REGULATOR WITH EXTERNAL PRESSURE TAP
	BACK-PRESSURE REGULATOR WITH EXTERNAL PRESSURE TAP
	VACUUM RELIEF VALVE
	PRESSURE RELIEF VALVE
	PRESSURE REDUCING REGULATOR WITH INTEGRAL OUTLET PRESSURE RELIEF AND PRESSURE GAUGE
	PRESSURE RELIEF VALVE
	RUPTURE / BURSTING DISC FOR PRESSURE RELIEF
	RUPTURE / BURSTING DISC FOR VACUUM RELIEF
	COMBINED VACUUM AND PRESSURE RELIEF VALVE

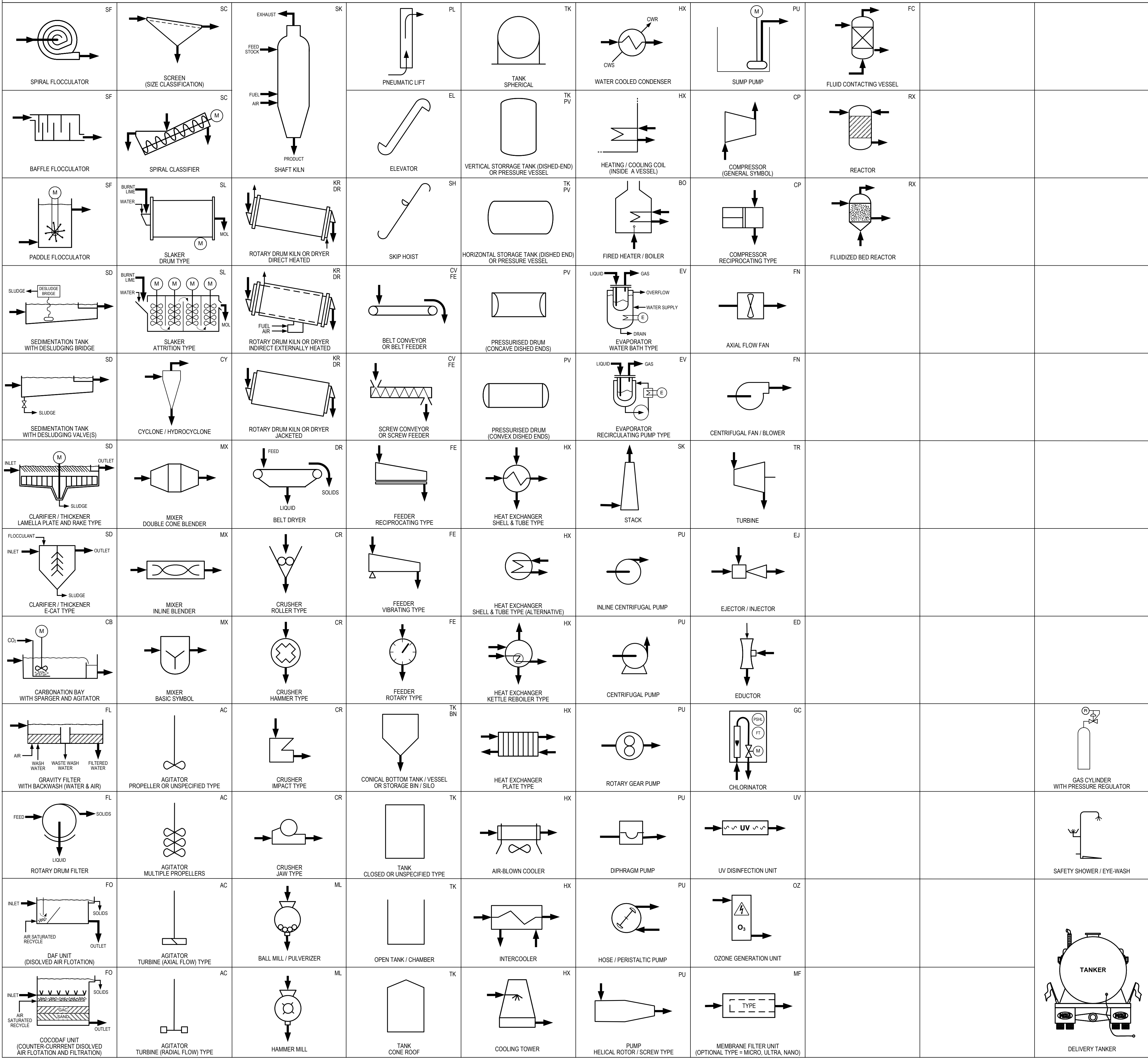
LEVEL MEASUREMENT & DEVICES

	LEVEL GAUGE GLASS (EXTERNALLY MOUNTED)
	LEVEL GAUGE GLASS (MOUNTED ON TANK)
	LEVEL INDICATING TRANSMITTER (TWO CONNECTIONS)

MISCELLANEOUS
MEASUREMENTS & DEVICES



EQUIPMENT SYMBOLS



DRG No. A9500

NOTES

- ALL PIPING AND INSTRUMENTATION SYMBOLS AND IDENTIFICATIONS ARE BASED ON AMERICAN NATIONAL STANDARD ANSI/ISA-85.1-1984 (R1992). FOR ADDITIONAL NOTES & SYMBOLS REFER TO THIS STANDARD.
- FOR THE PURPOSES OF WKS CODING / TAG NUMBERING OF INSTRUMENTS AND EQUIPMENT:
 - INSTRUMENT, FUNCTION AND EQUIPMENT SYMBOLS SHALL BE ACCOMPANIED BY A 2-4 DIGIT TAG NUMBER.
 - FOR INSTRUMENTS AND FUNCTION SYMBOLS, THIS TAG NUMBER SHOULD APPEAR INSIDE THE BUBBLE (SEE EXAMPLE ON SHEET 1 OF 2).
 - FOR EQUIPMENT SYMBOLS, THE TAG SHOULD APPEAR AS THE 2-3 LETTER EQUIPMENT TYPE CODE FOLLOWED BY THE TAG NUMBER (FOR EXAMPLE FCV-101, TK-05, SL-03, MX-02).
 - FOR WKS CODING PURPOSES, A 3 COLUMN CROSS-REFERENCING TABLE MUST APPEAR ON OR ACCOMPANY THE P&ID DIAGRAM INDICATING TAG NUMBER, WKS CODE AND DESCRIPTION.
- THE SIZE OF EQUIPMENT SYMBOLS MAY BE MODIFIED WHERE THE DRAWING WOULD OTHERWISE BECOME TOO CONGESTED OR WHERE A SPECIFIC PIECE OF EQUIPMENT IS A CORE ITEM IN THE PROCESS.

REVISIONS

No	DATE	CHECKED	APPROVED	DESCRIPTION
0	27/01/1993			ORIGINAL STANDARD (5 SHEETS)
1	19/06/2009			REVISED STANDARD (2 SHEETS)
2	23/02/2010			MINOR UPDATES TO STANDARD

A9499	RAND WATER STANDARDS - PIPING AND INSTRUMENTATION DIAGRAMS - SHEET 1 OF 2
NUMBER	TITLE
REFERENCE DRAWINGS	



SAP No.	-	CHECKED	
CONTRACT No.	-	SECTION HEAD	
ORIGINATOR	L. SOUTHEE	APPROVED	
DRAWN BY	L. SOUTHEE	CAPACITY	
DATE	23/02/2010	DATE	

PROCESS ENGINEERING STANDARD
RW-PES-00005

PIPING AND INSTRUMENTATION DIAGRAMS

SHEET 12 OF 12

SCALE	N.T.S.	WKS	DOC. TYPE	S
STATION				
R W	0 0 0 0 F A		D N Z	A
DRG No. A9500				REVISION 2