

## Drawing Services – 06D - Schematic Drawing Structure and Standards for Technology

### Corporate Work Instruction

Hazards	Personal Protective Equipment	Tools & Equipment

The following procedure is to be used in conjunction with the PWC Drawing Procedures.

This procedure provides standard information required by PWC in the construction of Drawings for Electrotechnology ie Electrical Schematics. The instruction/standards generally comply with Australian Standards A.S. 3702 – Item Designation in Electrotechnology, A.S. 2067 Switchgear assemblies and ancillary equipment for alternating voltages above 1kV. A.S. 1102 Graphical Symbols for Electrotechnology.

Section 1: Item designation for drawings in Electrotechnology

Section 2: Typical system for functional identification of small wiring.

Section 3: Colour coding notation, indicator and push button applications.

#### Section 1: Item designation for drawings in Electrotechnology

In a circuit diagram it is necessary to identify each item of equipment. The item identification consists of three parts used in the following order.

1. Kind of item
2. Number of item
3. Function of item

##### 1. Kind of Item

The item designation code provides information about an item. PWC have two distinct codes for denoting the kind of item (Device/Function).

##### A) Power Method – Refer Example 1

This method as per appendix A “Device Function Numbers for Control Equipment” is taken from B.S. 3939 and is the standard method used for the preparation of electrical schematics for generation distribution, control and protection.



Danger



Caution

Tag



Environmental



Permit



Document

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## **B) Water – General Electrical – Refer Example 2**

This method as per appendix B “Item Designation – List of Letter Codes for the Designation of Kind of Item” is taken from A.S. 3702 and is used for general low voltage electrical systems such as pumps, bores, building services etc.

### **2. Number of Item – Refer to Example 1 & 2**

The number is used to identify each item on a drawing, generally being allocated in a sequence 1 to N. The numbers can be used to identify the item regardless of the kind of item code or to distinguish between similar items within the same letter code.

### **3. Function of Item – Refer to Example 1 & 2**

Information about the function of an item is added to the first two parts by the use of a suitable graphic symbol refer to the cell library DP 50 ELECLIB.1.

4. For related procedures not covered in this document contact the PWC Drawing Services Manager.

See Example 1: Schematic Power

See Example 2: Schematic Water and General Electric

See Appendix A: Device Function Numbers B.S. 3939

See Appendix B: Item Designation – List of Letter Codes for the Designation of Kind of Item A.S. 3702

## **Section 2: Typical System for Function Identification of Small Wiring**

### **1. Scope**

To assist in the preparation of diagrams and for the purposes of checking circuits, fault finding and modification work, the ends of each wire should be identified by suitable marking to show function.

Each function, eg current transformer for primary protection; control circuit for circuit-breaker, can be defined by a distinctive code consisting of numbers or a combination of numbers and letters. There are a number of different codes in existence established by the various supply authorities. This document sets out one typical system which is based on the use of letters and numerals and complies with the requirements of AS 2067-1984.

### **2. Wiring Numbering Code**

#### **2.1 Identification – general**

Every branch of any connection should bear the same identification mark. Where, however, it is necessary to identify branches which are connected to a common point, eg current-transformer leads, different numbers for the branches may be employed only if they are connected through links, or are connected to separate terminals which are then joined by removable connections.

## 2.2 Identification according to function

A system of marking providing functional identification is described below and summarized in appendix C.

- a) Each wire should have a letter to denote its function eg control of circuit breaker, current transformer for primary protection, voltage for instruments, metering and protection.
- b) Each wire should have a suffix number identifying the individual wire and its function. This may consist of one or more digits as required. For functions A-G, H, J and M, the suffix numbers should be as given in the column under "Wire numbers". Direct-current supplies from a positive source should bear even numbers commencing from the source of supply. Where coils or resistors are connected in series the change from odd to even should be made at the coil or resistor lead nearest to the negative supply.
- c) Where a number of similar leads form separate units are taken to a common panel, eg bus-zone protection, summation metering, suffixes A, B, C, etc should be used to distinguish them.
- d) Where two associated equipment are mounted on one panel eg generator and unit transformer, HV and LV sides of one transformer, all leads of the subsidiary or lower-voltage equipment of the two should be distinguished by adding 50 to the numbers of wires in the common panel and associated interconnecting cores only.
- e) Where more than one function is covered by common apparatus, the first of the appropriate function letters in the table should be used. This applies only to parallel circuits and where these circuits split at a separate contact, eg fuse-link, switch or relay contact, the function letter should change if necessary from the splitting point onwards.
- f) Where relays are employed, the coil and the contact circuits do not necessarily bear the same function letter, which should be determined by the function of the individual circuit containing them, eg the coil circuit of an interposing relay should be 'W' but the contact circuits may bear letters such as 'K', 'L' or 'N', as appropriate.

- g) Current and voltage-transformer function letters should follow through any interposing and auxiliary current and voltage transformers, including such transformers when used for light-current circuits. Where an a.c. supply reflecting the primary quantities and derived from a current or voltage transformer is rectified for the operation of instruments or relays, the d.c. circuit should carry the same function letter as the a.c. circuit.
- h) Circuits having functions not included in the function letter table should not have prefix letters.
- i) Where the manufacturer has been unable to ascertain from the purchaser the function letters and numbering to be assigned to equipment wiring by the time that wiring is required, the manufacturer should himself provide wire numbers prefixed by the letter 'O'.
- j) Where the appropriate function letter only can be determined, its hold be preceded by an 'O' and followed by the manufacturer's own number. The same procedure may be applied in the case of equipment or parts of equipment not assigned to specific contracts at the time of manufacturer, subject the purchaser's approval and to the use of ferruling in accordance with approved standard diagrams to the extent that those diagrams apply.
- j. Light-current equipment, eg telephone-type or electronic signalling equipment, may require numbering schemes differing from the above for complete identification. In such cases, where connections from such equipment are associated with power equipment wired in accordance with this Appendix, the numbering of such connections should include the appropriate prefix letter (J, W, X or Y) to distinguish them.

### Section 3: Colour Coding Notation Indicator and Push Button Applications

#### 1. Identification of Conductors by Colours

- a) Where colours are used for identification purposes they should comply with Table 1 – Column 3 below.

Table 1: Correlation between alphanumeric notation, symbols and colours, AS 2067-1984.

Designation of Conductors		Alphanumeric Notation	Australian Practice
Alternating current system			
Supply	Phase 1	L1	Red (537)
	Phase 2	L2	White
	Phase 3	L3	Blue (166)
	Neutral	N	Black
Apparatus	Phase 1	U	Red (537)
	Phase 2	V	White
	Phase 3	W	Blue (166)
Direct current system	Positive	L+	Red (537)
	Negative	L-	Blue (166)
	Mid-wire	M	Black
Protective conductor or earth		PE or E	Green / Yellow
Noiseless (clean) earth		TE	Not specified

Note: The numbers in parentheses in Column 3 are the colour reference numbers from AS-K185.

#### 2. Indicator Lights

- a) Indicators lights shall be coloured in accordance with table 2 and these colours shall be employed for the typical applications nominated in the table.
- b) Positioning of indicator lights where red and green are employed as per table 2 to indicate two states of the same equipment shall be positioned as follows;

Red – on the top or to the right

Green – at the bottom or to the left

**Table 2 – Colours of Indicator Lights and their application, AS 2067-1984**

1	2	3	4	5
Colour	Meaning	Explanation	Specific Meaning	Typical Applications
RED	Danger or Alarm	Warning of conditional danger or a situation which required immediate action	Equipment alive (Danger)	Circuit-breaker or switch closed Turbine valve open CO <sub>2</sub> equipment in service
YELLOW (amber)	Caution	Change or impending change of conditions	Abnormal condition requiring action Automatic Trip	Conditions outside normal operating limits (temperature, pressure, etc). Abnormal circuit conditions causing operation of protection devices and disconnection
GREEN	Safety	Indication of a safe situation OR authorisation to proceed, ie clear way	Circuit disconnected (Conditional safety-see Note 1)	Circuit-breaker or switch open Turbine valve closed CO <sub>2</sub> equipment locked off
BLUE	Specific meaning assigned according to the need in the case considered	Blue may be given any specific meaning which is not covered by the colours RED, YELLOW and GREEN	Used in conjunction with or as an alternative to WHITE For a normal condition and to give information	Indication of remote control Selector switch in 'set up' position
WHITE	No specific meaning (neutral)	Any meaning may be used whenever doubt exists about the application of the three colours, RED YELLOW and GREEN and for example for confirmation.	Confirmation of expected change  Used to indicate a normal condition and to give information	Indication of position or state (isolators, starters etc)  Equipment working Motor or machine running Synchronizing lamps

**Note:**

1. The use of the colour GREEN does not necessarily indicate a safe situation for access to equipment which may still be alive.
2. Because it is more clearly seen, the colour WHITE should be used in preference to BLUE.
3. The colour WHITE may be employed in preference to YELLOW for alarm annunciators on central alarm panels labelled as alarm indications, to enable the annunciation to be more easily read.

### 3. Push Button Switches

- a) The colours of push buttons and typical applications are given in Table 3.
- b) Positioning of push button switches where two push button switches are used together to operate the same equipment should be positioned as follows.

To close, start, raise or put in the "ON" position – to the right or at the top.

To open, stop, lower or put in the "OFF" position– to be to the left or at the bottom.

**Table 3 – Colours of Push-Buttons and their application, AS 2067-1984**

1	2	3
Colour	Meaning of Colour	Typical Applications
Red	Action in case of emergency	Emergency stop (see NOTE) Fire Fighting
	Stop or Off	General Stop To stop one or more motors To stop a part or a machine To open a switching device Reset combined with 'stop'
Yellow (amber)	Intervention	Interventions to avoid danger of unwanted change
Green	Start or On	General start To start one or more motors To start a part of a machine To close a switching device
Blue	Any specific meaning not covered by RED, YELLOW and GREEN	A meaning not covered by the colours RED, YELLOW and GREEN, can be allocated to this colour in particular cases
Black Grey White	No specific meaning assigned	May be used for any function except for buttons with the sole function of 'stop' or 'off'

**4. Letter Codes for Colours**

<b>Colour</b>	<b>Letter Code</b>
Black	BK
Brown	BN
Red	RD
Orange	OG
Yellow	YE
Green	GN
Blue (including light blue)	BU
Violet (purple)	VT
Grey (slate)	GY
White	WH
Pink	PK
Gold	GD
Turquoise	TQ
Silver	SR
Green-and-yellow	GNYE

NOTE: The following abbreviations are superseded by the IEC conventions presented in the above. They are presented only for the interpretation of older drawings.

Black	BK	Blue	B
Brown	BN	Violet	V
Red	R	Grey	GY
Orange	O	White	W
Yellow	Y	Turquoise	T
Green	G	Slate	S