

Changes to Code of Practice 4

The following changes have been made to this document

- Headings for tables B1, B2, B3, B4, B5 and C3 have been changed to units of $\sin \phi$, to align with BS EN 62053-23 as shown below. A diagram has been inserted with table B1 to clarify the test point requirements for Reactive Meters for CoP 1 and 2 applications.
- New tables have been inserted into Appendix C (from BS EN 62053-22 and BS EN 62053-23), which state the percentage error limits for polyphase Active and Reactive Meters carrying a single-phase load, but with balanced polyphase voltages applied to their voltage circuits.

APPENDIX B. TEST POINTS

Meter Calibrations should be performed at the test points (values of currents) indicated in the following tables. The measured errors at these test points should not exceed the percentage error limits stated in the tables in Appendix C.

Where a test point is outside the range of the value of current given in the relevant table in Appendix C, the percentage error limit shall be taken from the percentage error limit from the value of current closest to the test point value. For example, for a CoP2 Class 0.5 active Meter, Tables B1 and B4 require it to be tested with a value of current of $0.01I_n$ at unity power factor. However, for this value of current and power factor there is no corresponding percentage error limit in Table C2. In this case the value of current (at unity power factor) nearest to $0.01I_n$, for a transformer operated Meter, is the range $0.02I_n \leq I < 0.05I_n$. Therefore, the appropriate percentage error limit will be $\pm 1.0\%$.

It should be noted that I_b refers to the basic current of a whole current Meter, I_n refers to the rated current of a transformer operated Meter and I_{max} to the maximum current rating of a Meter.

1. Type A Calibration Test Points

Table B1: Type A Meter Calibrations for Codes of Practice 1 and 2

Test Point	Active Meter			Reactive Meter		
Value of current (I)	System Power Factor			System Power Factor $\sin \phi$		
	Unity	0.5 Inductive	0.8 Capacitive*	Zero 1	0.8660 0.5 Inductive	0.8660 0.5 Capacitive
$0.01 I_n$	X					
$0.02 I_n$		X	X			
$0.05 I_n$	X (3), Y			X, Y		
$0.1 I_n$		X	X		X	X
$1.0 I_n$	X (2), Y (5)	X (4)	X	X, Y	X	X

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1.0 I_{max} or 1.2 I_n	X (1)	X	X	X	X	X
or						
1.5 I_n or 2.0 I_n^{**}						

Notes:
 These tests shall be carried out for Import/Export directions, as registered in SMRS or CMRS for a given metering point. If the same measuring element is used for both Import and Export one additional test point only (at 1.0 I_n , Unity Power Factor, balanced) is required in the reverse direction.
 X= all elements combined.
 Y = each element on its own.
 X,Y means tests should be carried out on all elements combined and each element on its own.
 *Tests at 0.5 capacitive Power Factor are acceptable.
 ** Determined by overload capacity of circuit. If unspecified test at 1.0 I_{max} .
 Numbers in brackets identifies, for reference only, those tests specified in Statutory Instruments 1998 No. 1566 Schedule 1, Table 2 and Schedule 3, Table 2.

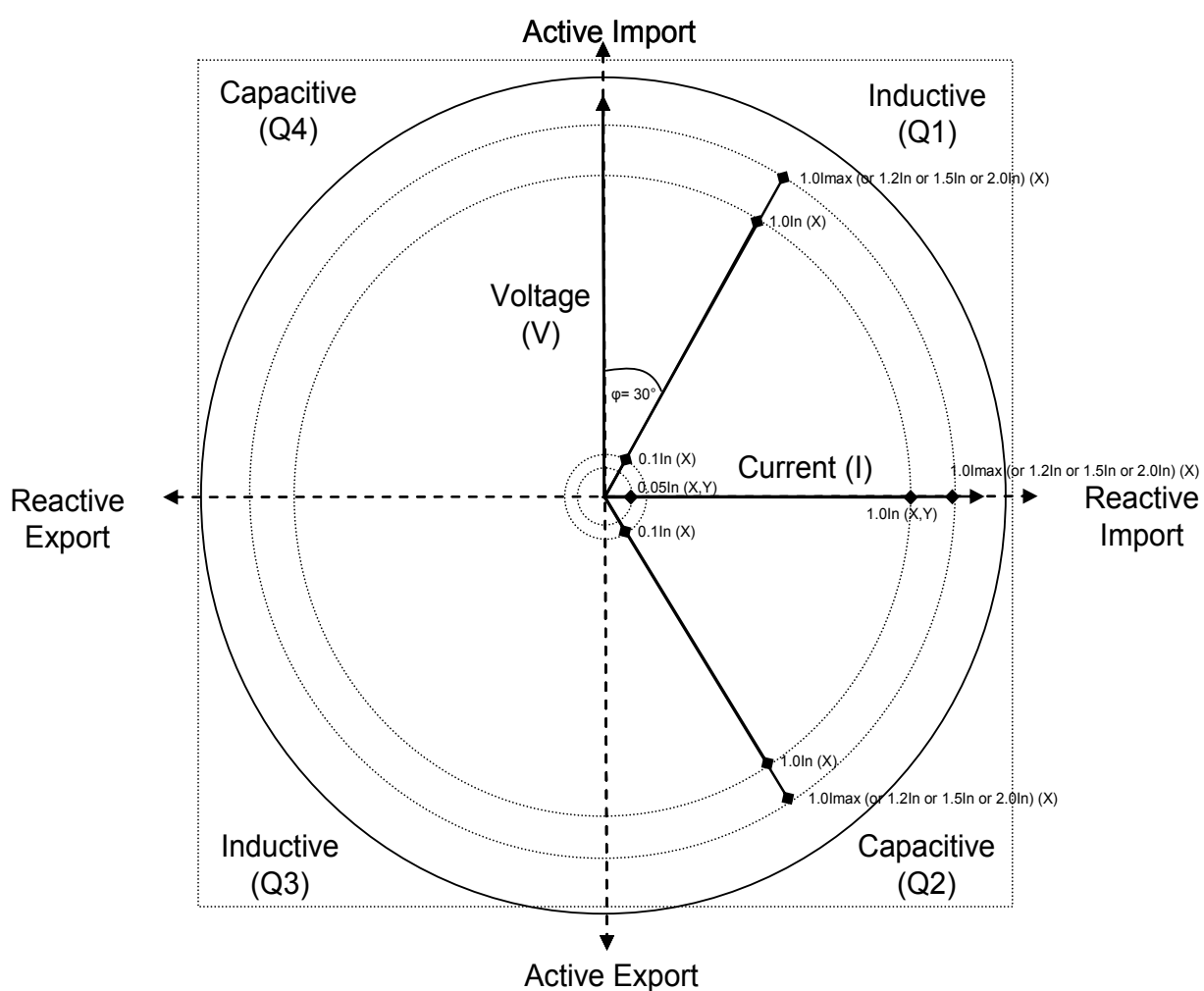


Figure 1: Example showing Type A Calibration Points for a CoP1 and 2 Reactive Energy Meter

Key

X = conduct tests on all elements combined

X,Y = conduct tests on all elements and each element on its own

Table B2: Type A Meter Calibrations for Codes of Practice 3, 5, 6 and 7

Test Point	Active Meter		Reactive Meter
Value of current (I)	System Power Factor		System Power Factor <u>Sin ϕ</u>
	Unity	0.5 Inductive	Zero <u>1</u>
0.05 I_b/I_n	X (3)		
1.0 I_b/I_n	X (2), Y (5)	X (4), Y (6)	X
1.0 I_{max}	X (1)		
Notes: These tests shall be carried out for Import/Export directions, as registered in SMRS or CMRS for a given metering point. If the same measuring element is used for both Import and Export one additional test point only (at 1.0 I_b/I_n , Unity Power Factor, balanced) is required in the reverse direction. X = all elements combined. Y = each element on its own. X,Y means tests should be carried out on all elements combined and each element on its own. Numbers in brackets identifies, for reference only, those tests specified in Statutory Instruments 1998 No. 1566 Schedule 1, Table 2 and Schedule 3, Table 2.			

1. Type B Calibration Test Points

Table B3: Type B Meter Calibrations for Codes of Practice 1 and 2

Test Point	Active Meter			Reactive Meter		
Value of current (I)	System Power Factor			Sin ϕ <u>System Power Factor</u>		
	Unity	0.5 Inductive	0.8 Capacitive*	Zero <u>1</u>	0.8660.5 <u>Inductive</u>	0.8660.5 <u>Capacitive</u>
0.05 I_n	X (3)			X		
0.1 I_n		X	X		X	X
1.0 I_{max} or 1.2 I_n or 1.5 I_n or 2.0 I_n^{**}	X (1)	X	X	X	X	X
Notes: These tests shall be carried out for Import/Export directions, as registered in SMRS or CMRS for a given metering point. If the same measuring element is used for both Import and Export one additional test point only (at 1.0 I_n , Unity Power Factor, balanced) is required in the reverse direction. X= all elements combined. *Tests at 0.5 capacitive Power Factor are acceptable. ** Determined by overload capacity of circuit. If unspecified test at 1.0 I_{max} . Numbers in brackets identifies, for reference only, those tests specified in Statutory Instruments 1998 No. 1566 Schedule 1, Table 2 and Schedule 3, Table 2.						

Type B Meter Calibration for Codes of Practice 3, 5, 6 and 7

For Codes of Practice 3, 5, 6 and 7:

1. Calibrate at prevailing load when the load current $> 0.1 I_n$ (or $> 0.1 I_b$ for whole current Meters) and Power Factor $> \pm 0.8$; or
2. Calibrate using an injection test when the load current $< 0.1 I_n$ (or $< 0.1 I_b$ for whole current Meters) and/or Power Factor $< \pm 0.8$. The injection test shall use as a minimum 1 test point at a current of $> 0.1 I_n$ (or $> 0.1 I_b$ for whole current Meters) and Power Factor $> \pm 0.8$.
3. Only the active Meter needs to be tested for Type B Meter Calibrations.

3. Type C Calibration Test Points

Table B4: Type C Meter Calibrations for Codes of Practices 1 and 2

Test Point	Active Meter			Reactive Meter		
Value of current (I)	System Power Factor			Sin ϕ System Power Factor		
	Unity	0.5 Inductive	0.8 Capacitive*	Zero 1	0.8660.5 Inductive	0.8660.5 Capacitive
0.01 I_n	X					
0.02 I_n		X	X			
0.05 I_n	X(3),Y			X,Y		
0.1 I_n		X	X		X	X
1.0 I_{max} or 1.2 I_n or 1.5 I_n or 2.0 I_n^{**}	X (1)	X	X	X		
Notes: These tests shall be carried out for Import/Export directions, as registered in SMRS or CMRS for a given metering point. If the same measuring element is used for both Import and Export one additional test point only (at 1.0 I_n , Unity Power Factor, balanced) is required in the reverse direction. X= all elements combined. Y = each element on its own. X,Y means tests should be carried out on all elements combined and each element on its own. *Tests at 0.5 capacitive Power Factor are acceptable. ** Determined by overload capacity of circuit. If unspecified test at 1.0 I_{max} . Numbers in brackets identifies, for reference only, those tests specified in Statutory Instruments 1998 No. 1566 Schedule 1, Table 2 and Schedule 3, Table 2.						

Table B5: Type C Meter Calibrations for Codes of Practices 3, 5, 6 and 7

Test Point	Active Meter		Reactive Meter
Value of current (I)	System Power Factor		System Power Factor <u>$\sin \phi$</u>
	Unity	0.5 Inductive	Zero <u>1</u>
0.05 I_b/I_n	X (3)		
1.0 I_b/I_n	X (2), Y (5)	Y (6)	X
Notes: These tests shall be carried out for Import/Export directions, as registered in SMRS or CMRS for a given metering point. If the same measuring element is used for both Import and Export one additional test point only (at 1.0 I_b/I_n, Unity Power Factor, balanced) is required in the reverse direction. X= all elements combined. Y = each element on its own. X,Y means tests should be carried out on all elements combined and each element on its own. Numbers in brackets identifies, for reference only, those tests specified in Statutory Instruments 1998 No. 1566 Schedule 1, Table 2 and Schedule 3, Table 2.			

APPENDIX C. MEASURED ERRORS

The following tables state the percentage error limits for each Class of Meter and include both whole current Meters and CT/VT operated Meters. Reference should be made to the relevant Code of Practice for the minimum Meter Class accuracy requirements.

It should be noted that I_b refers to basic current of a whole current Meter, I_n to the rated current of a transformer operated Meter and I_{max} to the maximum current rating of a Meter.

1. Accuracy Tables for Active Meters

Table C1: Summary of Class accuracy requirements for Class 0.2S and Class 0.5S Meters (single-phase Meters and polyphase Meters with balanced loads)

Value of current (I)	Power factor (Cos Ø)	Percentage error limits for Meters of Class	
		0.2S	0.5S
$0.01 I_n \leq I < 0.05 I_n$	1	+/- 0.4	+/- 1.0
$0.05 I_n \leq I \leq I_{max}$	1	+/- 0.2	+/- 0.5
$0.02 I_n \leq I < 0.1 I_n$	0.5 inductive	+/- 0.5	+/- 1.0
	0.8 capacitive	+/- 0.5	+/- 1.0
$0.1 I_n \leq I \leq I_{max}$	0.5 inductive	+/- 0.3	+/- 0.6
	0.8 capacitive	+/- 0.3	+/- 0.6

Source: BS EN 62053 - 22

Table C1(a): Summary of Class accuracy requirements for Class 0.2S and Class 0.5S Meters (polyphase Meters carrying a single-phase load, but with balanced polyphase voltages applied to voltage circuits):

<u>Value of current</u> (I)	<u>Power Factor</u> (Cos Ø)	<u>Percentage error limits for Meters of Class</u>	
		<u>0.2s</u>	<u>0.5s</u>
<u>$0.05 I_n \leq I \leq I_{max}$</u>	<u>1</u>	<u>± 0.3</u>	<u>± 0.6</u>
<u>$0.1 I_n \leq I \leq I_{max}$</u>	<u>0.5 inductive</u>	<u>± 0.4</u>	<u>± 1.0</u>

Source: BS EN 62053 - 22

The difference between the percentage error when the Meter is carrying a single-phase load and a balanced polyphase load at rated current I_n and unity power factor shall not exceed 0.4% and 1.0% for Meters of classes 0.2s and 0.5s respectively.

Table C2: Summary of Class accuracy requirements for Class 0.5, Class 1 and Class 2 Meters (single-phase Meters and polyphase Meters with balanced loads)

Value of current (I)		Power factor (Cos Ø)	Percentage error limits for Meters of Class		
For whole current Meters	For transformer operated Meters		0.5	1	2
$0.05 I_b \leq I < 0.1 I_b$	$0.02 I_n \leq I < 0.05 I_n$	1	+/- 1.0	+/-1.5	+/- 2.5
$0.1 I_b \leq I \leq I_{max}$	$0.05 I_n \leq I \leq I_{max}$	1	+/- 0.5	+/-1.0	+/- 2.0
$0.1 I_b \leq I < 0.2 I_b$	$0.05 I_n \leq I < 0.1 I_n$	0.5 inductive	+/- 1.3	+/- 1.5	+/- 2.5
		0.8 capacitive	+/- 1.3	+/- 1.5	-
$0.2 I_b \leq I \leq I_{max}$	$0.1 I_n \leq I \leq I_{max}$	0.5 inductive	+/- 0.8	+/- 1.0	+/- 2.0
		0.8 capacitive	+/- 0.8	+/- 1.0	-

Source: BS EN 62053 – 11 and BS EN 62053 - 21

2. Accuracy Tables for Reactive Meters

Table C3: Summary of Class accuracy requirements for Class 2 and Class 3 Meters

Value of current (I)		Power factor (Cos Ø) Sin Ø (inductive or capacitive)	Percentage error limits for Meters of Class	
For whole current Meters	For transformer operated Meters		2	3
$0.1 I_b \leq I \leq I_{max}$	$0.05 I_n \leq I \leq I_{max}$	Ø1	+/- 2.0	+/- 3.0
$0.2 I_b \leq I \leq I_{max}$	$0.1 I_n \leq I \leq I_{max}$	0.866 inductive or capacitive 0.5	+/- 2.0	+/- 3.0

Source: BS EN 62053 - 23

Table C3(a): Summary of Class accuracy requirements for Class 0.2S and Class 0.5S Meters (polyphase Meters carrying a single-phase load, but with balanced polyphase voltages applied to voltage circuits):

Value of current (I)		Sin Ø (inductive or capacitive)	Percentage error limits for Meters of Class	
For whole current Meters	For transformer operated Meters		2	3

<u>0.1 $I_b \leq I \leq I_{max}$</u>	<u>0.05 $I_n \leq I \leq I_{max}$</u>	<u>1</u>	<u>+/- 3.0</u>	<u>+/- 4.0</u>
<u>0.2 $I_b \leq I \leq I_{max}$</u>	<u>0.1 $I_n \leq I \leq I_{max}$</u>	<u>0.5</u>	<u>+/- 3.0</u>	<u>+/- 4.0</u>

Source: BS EN 62053 - 23

The difference between the percentage error when the Meter is carrying a single-phase load and a balanced polyphase load at basic current I_n and $\sin \phi = 1$ for direct connected Meters, respectively at rated current I_n and $\sin \phi = 1$ for transformer operated Meters, shall not exceed 2.5% and 3.5% for Meters of classes 2 and 3 respectively.

No further changes have been made to this document