

Australian Government

Department of Industry, Innovation and Science

National Measurement Institute

36 Bradfield Road, West Lindfield NSW 2070

Certificate of Approval NMI 6/14D/13

Issued by the Chief Metrologist under Regulation 60 of the National Measurement Regulations 1999

This is to certify that an approval for use for trade has been granted in respect of the instruments herein described.

Control Systems Technology Model PFS4 Belt Weighing Instrument

submitted by Control Systems Technology Pty Ltd 47 Fitzpatrick Street Revesby NSW 2212

NOTE: This Certificate relates to the suitability of the pattern of the instrument for use for trade only in respect of its metrological characteristics. This Certificate does not constitute or imply any guarantee of compliance by the manufacturer or any other person with any requirements regarding safety.

This approval has been granted with reference to document NMI R 50, *Continuous totalising automatic weighing instruments (belt weighers), Parts 1 and 2*, dated July 2004.

This approval becomes subject to review on 1/10/20, and then every 5 years thereafter.

Rev	Reason/Details	Date
0	Pattern provisionally approved – interim certificate issued	24/08/94
1	Pattern & variants 1 to 7 approved – interim certificate issued	29/09/97
2	Pattern & variants 1 to 7 approved – certificate issued	17/02/98
3	Variant 8 approved – certificate issued	17/01/03
4	Variant 9 approved – certificate issued	16/02/04
5	Variant 10 approved (incl. review) – certificate issued	19/04/12
6	Variants 11 to 13 provisionally approved – interim certificate issued	03/10/14

DOCUMENT HISTORY

Document History (cont...)

Rev	Reason/Details	Date
7	Variant 14 approved – interim certificate issued	02/12/14
8	Variant 14 amended (validity) – interim certificate issued	13/10/15
9	Pattern & variants 1 to 11 reviewed & updated – variants 11 to 14	06/11/15
	approved – certificate issued	
10	Variant 15 provisionally approved	17/01/17
11	Variant 15 amended & variant 16 approved – certificate issued	31/05/19

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI (or NSC) 6/14D/13' and only by persons authorised by the submittor.

Instruments purporting to comply with this approval and currently marked 'NMI (or NSC) P6/14D/13' may be re-marked 'NMI (or NSC) 6/14D/13' but only by persons authorised by the submittor.

It is the submittor's responsibility to ensure that all instruments marked with this approval number are constructed as described in the documentation lodged with the National Measurement Institute (NMI) and with the relevant Certificate of Approval and Technical Schedule. Failure to comply with this Condition may attract penalties under Section 19B of the National Measurement Act and may result in cancellation or withdrawal of the approval, in accordance with document NMI P 106.

Auxiliary devices used with this instrument shall comply with the requirements of General Supplementary Certificates No S1/0/A or No S1/0B.

This approval shall NOT be used in conjunction with General Certificate No 6B/0.

Special: For the pattern and all variants

Instruments must comply with all calculations provided in the Test Procedure No 6/14D/13 attached herein.

Special Conditions of Approval: (Variant 7)

This variant is limited to one (1) instrument having serial number 217 located at the Yallourn power station in Victoria, and six (6) instruments having serial numbers 158, 159, 160, 161, 162, and 163 located at the Loy Yang power station in Victoria.

Special Conditions of Approval: (Provisional Approval – Variant 15)

This variant is provisional pending:

- (a) consideration of OIML R50:2014 for adoption as an NMI requirements document; and
- (b) Completion of satisfactory in-situ testing of a sample installation and evaluation of results (results of verification testing shall be copied to the Pattern Approval Section at NMI).

Instruments purporting to comply with this variant shall be marked with approval number 'NMI P6/14D/13' and only by persons authorised by the submittor. (Note: The 'P' in the approval number may be a temporary marking.)

R50:2014 for adoption as an NMI requirement indicate that it is necessary; the approval of this variant may be cancelled (or varied).

The submittor shall implement such modifications as required by NMI. In the event that such modifications (if any are required by NMI) are not made to the satisfaction of NMI, the approval of this variant may be withdrawn.

Signed by a person authorised by the Chief Metrologist to exercise their powers under Regulation 60 of the *National Measurement Regulations 1999*.

Darryl Hines Manager Pattern Approval, Policy and Licensing Section

1. Description of Pattern provisionally approved on 24/08/94 approved on 29/09/97

The pattern is a Control Systems Technology model PFS4 class 1 belt weigher of 1400 t/h maximum flow rate, approved for use over a flow rate range of 20% to 100% of maximum flow rate.

Instruments are approved with a weigh length of 7.2 m and a belt speed of 3.0 m/s.

Means are provided to ensure that the conveyor cannot move in the reverse direction.

1.1 Basework

The model PFS4-6 weighframe has six idler rollers mounted on a frame. (Figure 1 shows a model PFS4-4 four idler roller for simplicity). The frame is suspended from four Precision Transducers model LS250 load cells of 250 kg capacity which are mounted on two support beams which span the conveyor stringers. The weigh frame is stabilised by four tie rods, and may be installed at an incline of up to 18° from horizontal.

1.2 Belt Speed Sensor

The belt speed may be sensed by one of the following methods:

- (i) The use of a proximity sensor to detect target flags attached to the driven conveyor pulley of the belt conveyor (models BTS and TRS); or
- (ii) The use of a proximity sensor to detect target flags attached to the spiral cage pulley of the belt conveyor (model SCP); or
- (iii) Use of a precision pre-calibrated tachometer assembly (which also uses a proximity sensor).

1.3 Computing and Totalising Unit

A Control Systems Technology model IPM-10 integrator/totaliser (Figure 2) is used.

It may be fitted with output sockets for the connection of auxiliary and/or peripheral equipment.

1.4 Sealing Provision

Provision is made for the calibration adjustments to be sealed by sealing the access door of the IPM-10 integrator/totaliser. A switch within the cabinet disables the ability to access calibration and configuration options from the instrument keyboard (access to zero adjustment capabilities continues to be accessible).

1.5 Verification Provision

Provision is made for a verification mark to be applied.

1.6 Marking

Instruments are marked with the following information, on one or more permanently attached nameplates:

Manufacturer's mark, or name written in full	
Indication of accuracy class	class 1 or class 2
Type designation (model number) of the	
instrument	
Serial number of the instrument	
Pattern approval mark for the instrument	NMI (or NSC) No 6/14D/13
Maximum flow rate	Q _{max} = kg/h or t/h
Minimum flow rate	Q _{min} = kg/h or t/h
Minimum totalised load	$\sum_{min} = \dots kg$ or t
Maximum capacity of the weighing unit	Max = kg or t
Totalisation scale interval	d = kg or t
Belt speed	v = m/s
Weigh length	L = m
Temperature range	-10°C / 40°C
Designation of product(s) to be weighed (if not	
fixed by installation conditions).	

In addition to the above markings the instrument shall bear the inscription:

"Zero testing shall have a duration of at least ... revolutions".

The number of revolutions in this statement shall be a whole number of revolutions (at least one) and of a duration as close as possible to 3 minutes.

2. Description of Variant 1

approved on 29/09/97

Certain other models of the PFS4 series of class 1 belt weighers. Instruments use a PFS4 (#) series weighframe fitted with from two to eight idler rollers. The weighframe may be installed at an incline of up to 18° from horizontal.

(#) The model number has a suffix indicating the number of idler rollers, e.g. model PFS4-8 has eight idler rollers.

3. Description of Variant 2

approved on 29/09/97

Certain models of the PCS2 series of class 1 belt weighers. Instruments use a PCS2 weighframe (Figure 3) to replace the PFS4 weighframe of the pattern.

The PCS2 (#) series weighframe may use from two to six idler rollers mounted on a frame which is centrally suspended from two Precision Transducers model LS250 load cells of 250 kg capacity which are mounted on a central support beam joining two beams which span the conveyor stringers. The weigh frame is stabilised by five tie rods, and may be installed at an incline of up to 18° from horizontal.

(#) The model number has a suffix indicating the number of idler rollers, e.g. model PCS2-4 has four idler rollers.

4. Description of Variant 3

approved on 29/09/97

With alternative versions of the IPM-10 integrator/totaliser, as shown below.

Model	Description
IPM-10-LCD	With two line LCD display and software modified to suit this display (Figure 4)
IPM-14-LCD	Similar to IPM-10-LCD but with four line LCD display and software modified (with enhanced menu structure)

The above models may be provided in alternative housings (the housing type may be appended to the model number).

Housing Type	Description
STD, Industrial or Mining	Various types of mild steel enclosure
IP66	Mild steel enclosure (dust and water protected)
DIP	Dust ignition proof housing
SS	Stainless steel enclosure

5. Description of Variant 4

approved on 29/09/97

The pattern and variants as class 2 belt weighers.

6. Description of Variant 5

approved on 29/09/97

With the PFS4 or PCS2 series weighframes using a load cell mounting in which the load is applied to Kelba model KA-1000-C3 1000 kg capacity load cells by means of a ball and cup arrangement (Figure 5). Stabilising tie rods are fitted to the weighframe as described for the appropriate weighframe.

7. Description of Variant 6

approved on 29/09/97

approved on 29/09/97

The pattern or variants with various maximum and minimum flow rates, with weighframes of various capacities using Commission-approved, beam type load cells of various capacities.

The instruments may be of various weigh lengths, and with various belt speeds. The minimum flow rate shall be not less than 20% of the maximum flow rate.

Included in this Technical Schedule is a set of calculations which should be used to determine the suitability of the load cells in a particular belt weigher. Refer to the Special Conditions of Approval.

8. Description of Variant 7

With the PFS4-6 weighframe of the pattern using a 'POD' type load cell mounting (Figure 6) in which an arrangement of flexure plates is used to apply the load to the Kelba model KA-1000-C3 1000 kg capacity load cells. Stabilising tie rods are **not** fitted to the weighframe.

This variant is limited to one instrument located at the Yallourn power station and six instruments located at Loy Yang power station, Yallourn Victoria.

Note: These instruments may alternatively be modified by addition of stabilising rods and ball and cup arrangements so that they are similar to the PFS4 instruments described in variant 5.

Refer to the Special Conditions of Approval.

9. Description of Variant 8

approved on 17/01/03

The pattern and variants using a Control Systems Technology model IPC-14-S integrator/totaliser (Figure 7), with main board designated WM-C and software dated March 2002 or later, as class 0.5, 1 or 2 belt weighers.

Included in this Technical Schedule is a set of calculations which should be used to determine the suitability of the load cells in a particular belt weigher. Refer to the Special Conditions of Approval.

9.1 Sealing

For the IPC-14-S integrator/totaliser, access to the calibration facilities is secured by a password, and evidence of alteration of the calibration is provided by an audit trail.

(i) Password

Normal operation of the instrument is in 'Access Level 0'. Alteration of calibration may only be carried out in 'Access Level 2', and a password is required to enter this level.

(ii) Evidence of calibration alteration (audit trail)

The audit trail records each change to the calibration and set-up parameters of the instrument, including old and new values. Access to the audit trail may be obtained by the following procedure:

- (a) Select '(4) Print/Log' at the 'Start Menu' (main menu).
- (b) Select '(3) Audit' at the 'Printed Reports and Audit' menu which then appears.
- (c) The 'Audit Setup Parameters' menu which then appears provides for the printing or viewing of the audit trail.
- (d) Select '(2) View On Screen' to view the audit trail information and use '(1) Up', '(2) Down', and '(3) Exit' to examine the audit trail. The information is provided in a form similar to that shown below (where the parameter number '166 Mass Span Const kg/AD' was changed).

Review Setup Audit (1)Up (2)Down (3)Exit Change No. 001 Tue 31/05/2007 12:20:52 166 Mass Span Const kg/AD was 0.01 on this date was changed to 0.00953276

The 'Change No. ###' is incremented whenever calibration or set-up parameters are changed.

The most recent 'Change No.' shown should be recorded onto the calibration/ verification label to indicate the value when calibration/verification was carried out.

Any discrepancy between the 'Change No.' recorded on the calibration/verification label, and the most recent 'Change No.' indicated in step (d) indicates that calibration or set-up parameters have been altered. If there is no discrepancy it is clear that there has been no alteration.

Note: The alteration of some set-up parameters may be acceptable, so that in case of any discrepancy it is necessary to examine the changes which have occurred since the change no recorded at verification/certification.

The following variables clearly affect calibration, and alteration of them is NOT acceptable.

- 100 Belt Length m =
- 102 Weigh Length m =
- 105 Live load adjustment=
- 106 Linearisation Threshold(1) %=
- 107 Linearisation Adjustment(1) %=
- 108 Linearisation Threshold(2) %=
- 109 Linearisation Adjustment(2) %=
- 110 Linearisation Threshold(3) %=
- 111 Linearisation Adjustment(3) %=
- 160 Belt Length (pulses)=
- 160 Partial Belt Length (pulses)=
- 166 Mass Span Const kg/ADCnt=

10. Description of Variant 9

approved on 16/02/04

approved on 19/04/12

An alternative weighframe for the the model PFS4-*-OD instrument (where * represents the number of idlers) in which the load is applied to the load cells by means of a rod arrangement (Figure 8) rather than the ball and cup arrangement of variant 5.

11. Description of Variant 10

Control Systems Technology (CST) models PFS4 or PCS2 class 0.5 belt weighers now using IPC-14-S integrator/totaliser (Figure 7) and model Closed Space Roller Ramp (CSRR) style weigh frames (Figure 9).

12. Description of Variant 11 provisionally approved on 3/10/14 approved on 6/11/15

The pattern and variants using the model IPC-14-S with updated software (version 0923167r.tsk or later) having additional features, including those mentioned in variants 12 and 13 below.

13. Description of Variant 12 provisionally approved on 3/10/14 approved on 6/11/15

The model IPC-14-S, having two belt speed sensors, configured to operate in a 'dual redundant' way.

The operation of both belt speed sensors is monitored by the IPC 14 to identify a failure of either speed sensor arrangement (e.g. by detection of missing or additional pulses). Where such a failure is identified by the system, it is able to use the alternative speed sensor input to continue operation.

In the case of a speed sensor failure, an alarm is raised by the system. If both speed sensor inputs are determined to be faulty, an alarm will occur and [the IPC 14 will cease to operate].

The two speed sensors may be of different types (e.g. as per clause **1.2 Belt Speed Sensor** (i), (ii) or (iii)), and have differing pulse per metre values.

- Note: (a) Use of two speed sensors as described in this variant is approved, however it is not required (i.e. use with a single speed sensor remains acceptable).
 - (b) Where two belt speed sensors are provided and these provide different pulse per metre values, verification shall be carried out with the speed sensor which provides the lesser number of pulses per metre. A check shall be carried out to ensure satisfactory operation with the alternative speed sensor.

14. Description of Variant 13provisionally approved on 3/10/14approved on 6/11/15

The model IPC-14-S, operating with a 'belt profile correction device'.

The belt profile correction device corrects for variations in the load applied to the load receptor by an (empty) belt during a belt revolution. The device maintains a stored profile of the (empty) belt load over a full revolution. This device utilises a belt synchronisation mechanism (a software routine and/or detection of a marker in the belt) to ensure synchronisation of the stored profile with the actual belt location.

This device operates in conjunction with the automatic zero-setting device of the IPC-14-S.

15. Description of Variant 14

A system in which the Control Systems Technology model IPC-14-S belt weigher indicator is used with the basework being that of a Ramsey Technology model 10-17-4/2 belt conveyor weigher (NMI Certificate 6/14D/11B). This variant is not for the construction of new baseworks of this type, but is intended to approve the instrument formed by replacement of the computing and totalising unit of 6/14D/11B with the IPC-14-S computing and totalising unit of this approval. The belt sensor of 6/14D/11B is also replaced by a belt speed sensor of this certificate.

This variant is for approval as a Class 1 or 2 belt weigher and is limited to a single instrument (BW3412) located at

Callide Power Station (CS Energy) 959 Callide Dam Road Biloela QLD 4715

16. Description of Variant 15 provisionally approved on 17/01/17 amended on 31/05/19

The pattern and variants of Class 0.5, using a Control Systems Technology model Cargo Superintendent version WIM3 integrator/totaliser (Figures 10 and 11) instead of the IPM-10, IPM-10-LCD, IPM-14-LCD or IPC-14-S integrator/totaliser mentioned elsewhere.

approved on 02/12/14

Included in this Technical Schedule is a set of calculations which should be used to determine the suitability of the load cells in a particular belt weigher. Refer to the Special Conditions of Approval.

16.1 Computing and Totalising Unit

The Control Systems Technology model Cargo Superintendent version WIM3 integrator/totaliser utilises a colour touch screen LCD screen for its operator interface (Figure 11).

Additional facilities include:

- Non-resettable totaliser
- Resettable totaliser
- Linearisation
- Temperature Compensation (based on data from a Control Systems Technology supplied temperature sensor)
- Automatic zero setting device
- Automatic zero tracking
- Belt profile correction device
- PC operator interface (optional)
- Dual displacement (speed) sensor

16.2 Dual basework capability

The Control Systems Technology model Cargo Superintendent version WIM3 integrator/totaliser is able to function as the indicator/totaliser for two belt conveyor baseworks. Where two baseworks are fitted, the equipment should be treated as two systems and verified accordingly.

16.3 Sealing

For the Cargo Superintendent version WIM3 integrator/totaliser, access to the calibration facilities is secured by a password, and evidence of alteration of the calibration is provided by an audit trail.

The firmware version identification is accessible through the "Info" | "Unit" menus of the system, and should be version 20161209 or later.

17. Description of Variant 16

approved on 31/05/19

The pattern and variants of Class 2 or 1, using a Control Systems Technology model Cargo Superintendent version WIM3 integrator/totaliser (Figures 10 and 11) instead of the IPM-10, IPM-10-LCD, IPM-14-LCD or IPC-14-S integrator/totaliser mentioned elsewhere.

Included in this Technical Schedule is a set of calculations which should be used to determine the suitability of the load cells in a particular belt weigher.

TEST PROCEDURE

Instruments shall be tested in accordance with any relevant tests specified in the National Instrument Test Procedures.

The instrument shall not be adjusted to anything other than as close as practical to zero error, even when these values are within the maximum permissible errors.

Maximum Permissible Errors

The maximum permissible errors are specified in the *National Trade Measurement Regulations 2009.*

CALCULATIONS

1. Load cell(s) – number of verification intervals

Class 0.5: $n_{max} \ge 1500$ Class 1: $n_{max} \ge 1000$ Class 2: $n_{max} \ge 500$

2. Load cell(s) – capacity

$$E_{\max} \ge \frac{Max + DL}{N \cdot r}$$

3. Temperature effect on the minimum load on the load cell(s)

$$\begin{array}{ll} \text{Class 0.5:} & v_{min} \leq \frac{0.00025 \cdot Max}{r \cdot \sqrt{N}} \\ \text{Class 1:} & v_{min} \leq \frac{0.0005 \cdot Max}{r \cdot \sqrt{N}} \\ \text{Class 2:} & v_{min} \leq \frac{0.001 \cdot Max}{r \cdot \sqrt{N}} \end{array}$$

where:

 E_{max} = Maximum capacity of the load cell(s)

Max = Capacity of the weighframe at maximum flow rate

$$=rac{Q_{\max}\cdot L}{V}$$

DL = Dead load of weighframe

N = Number of load cells supporting weighframe

r = Lever ratio (r = 1 if system does not use levers)

$$L = Weigh length$$

V = Belt speed

 Q_{max} = Maximum flow rate

 v_{\min} = Minimum value of verification interval for the load cell(s)

 n_{max} = Maximum number of verification intervals for the load cell(s)



Control Systems Technology Model PFS4-4 Weighframe (Pattern)

FIGURE 6/14D/13-2



Control Systems Technology Model IPM-10 Indicator



Control Systems Technology Model PCS2-2 Weighframe (Variant 3)



FIGURE 6/14D/13-4

Control Systems Technology Model IPM-10-LCD Indicator (Variant 3)





Weighframe With Ball and Cup Type Load Cell Mounting (Variant 5)



PFS4 Weighframe With 'POD' Type Load Cell Mounting (Variant 7)



Control Systems Technology Model IPC-14-S Integrator/Totaliser (Variant 8)



Rod Type Load Application Arrangement (Variant 9)



Control Systems Technology Model CSRR Style Weigh Frame (Variant 10)

FIGURE 6/14D/13 - 10



Control Systems Technology Model Cargo Superintendent version WIM3 integrator/totaliser (Variants 15 &16)

CST Mass and Volume Information System [™] Fri Jan 13 15:55:23 2017					
Belt 1: 19.85C* Belt Scale Zero Tracking On			Belt Scale Zero Tracking Off		
2701.995t			627.685t		
24905.380 t			8472.195t		
1000 t/hr 500 t/hr 0 t/hr	Flow rate 0.00	Ot/hr	1000 t/hr 500 t/hr 9 t/hr	0.00	Ot/hr
6 m/sec 3 m/sec _{5 m} 0 m/sec	Belt Speed	0m/sec	6 m/sec 3 m/sec 0 m/sec	Belt Speed	0 m/Sec
100000 kg 50000 kg 0 kg	Weight (WLW)	kg	100000 kg 50000 kg 0 kg	Weight (WLW)	٢g
Front	Level 0	Info	Belt1	Belt2	System

Control Systems Technology Model Cargo Superintendent version WIM3 integrator/totaliser – typical operator interface (Variants 15 & 16)

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